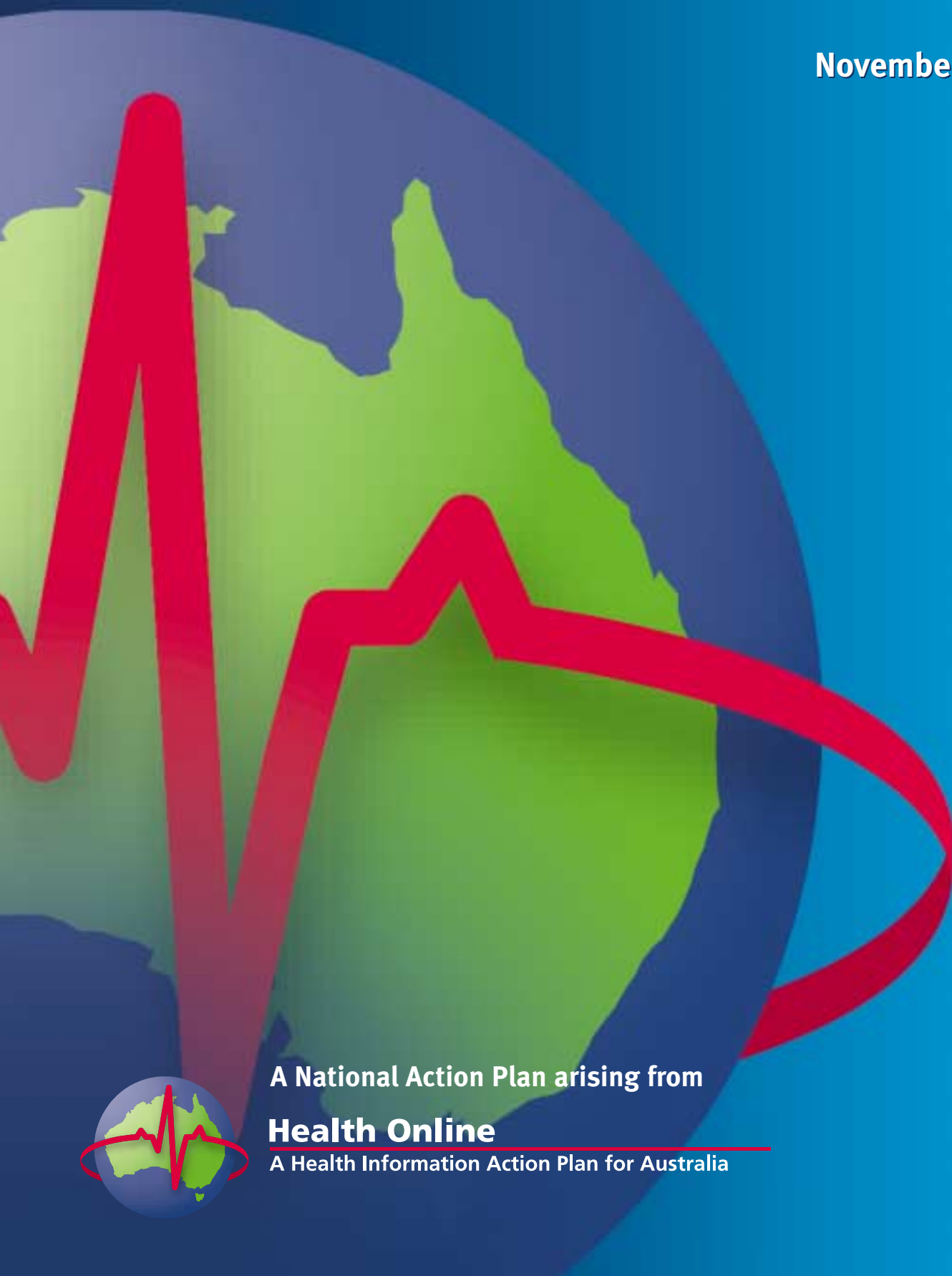


# Electronic Decision Support for Australia's Health Sector

NATIONAL ELECTRONIC DECISION SUPPORT TASKFORCE

November 2002



A National Action Plan arising from

**Health Online**

A Health Information Action Plan for Australia



# **Electronic Decision Support for Australia's Health Sector**

**Report to Health Ministers by the  
National Electronic Decision Support Taskforce**

**November 2002**

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ISBN: 0 642 82161 5

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First published: January 2003

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# TERMS OF REFERENCE

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The Taskforce's terms of reference were to:

- Define the governance structure that needs to be put in place to ensure a national coordinated approach to the development of electronic decision support systems to aid clinical decision making at the point of care.
- Prepare an inventory of large-scale electronic decision support activities and expenditure in Australia.
- Consider existing electronic decision support activities in Australia in terms of:
  - evidence on the effectiveness and costs of electronic decision support systems in improving clinical outcomes in different health care settings
  - factors that were critical to ensuring successful developments as well as barriers to successful developments of electronic decision support systems
  - likely benefits of a more coordinated approach in the development of electronic decision support systems for patients, carers and health service providers.
- Consult with stakeholders to determine the needs of the health information industry in relation to sustainability and viability and the needs of clinicians in relation to decision support information and the uptake of electronic decision support systems.
- Define the additional work program that needs to be undertaken (eg on implementing key building blocks that would underpin the operation of electronic decision support systems) to ensure the development of sustainable, nationally integrated electronic decision support systems.
- Develop a report for Health Ministers by November 2002 recommending a way ahead for ensuring a national approach to the development of electronic decision support systems, including governance arrangements, priorities, timetables and costings.

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# FOREWORD

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It gives me great pleasure to introduce this report by the National Electronic Decision Support Taskforce — a Taskforce set up by the National Health Information Management Advisory Council (NHIMAC).

Never have medical practitioners been faced with such an explosion in the amount of medical knowledge. A hundred years ago Sir William Osler, the pre-eminent medical educator of his day, confidently believed it was possible for a medical man or woman to know the entire compass of medical knowledge. No one would hold that view today.

Clinicians can no longer rely on memory alone but must use knowledge storage systems. More of that knowledge is now stored electronically. Because the amount of knowledge is staggering, clinicians rely increasingly on computer programs to sift or manipulate it. Meanwhile consumers often present with reams of information gained from the Internet, oft times better informed about rare diseases or subtle idiosyncrasies than their clinician. But because of the quantity of information, clinicians and consumers are faced with the difficulty of sorting the wheat from the chaff.

To facilitate access to high-quality evidence on what is best-practice health care, electronic decision support systems are essential. They can make a difference to the quality of health care — by giving clinicians and consumers access to relevant, evidence-based information at the point of care. However, for these electronic decision support arrangements to be effective, it is essential that there is a nationally coordinated approach to developing them and that a national governance structure is in place to provide direction and coordination. This report reflects the high level of consensus among the health sector for the establishment of a national overarching body to govern developments in electronic decision support systems.

An integral part of the work of the Taskforce has been to recommend a way ahead for ensuring a national approach to the development of electronic decision support systems, including governance arrangements, priorities, timetables and costings. In addition, the Taskforce has defined the additional work program that needs to be undertaken (eg on implementing the building blocks that would underpin the operation of electronic decision support systems) to ensure the development of sustainable, nationally integrated, electronic decision support systems.

I would like to take this opportunity to thank all those people who contributed to the work of the Taskforce: first, my fellow members who contributed their time and

expertise; second, the many individuals and organisations who attended focus groups and participated in interviews; third, the consultants, for their efforts in assisting us.

Finally, I would like to thank the members of the Secretariat (Irene Krauss, Abha Bedi, Sandra Dorsett, Heather Lyall and Jenny Burton) who contributed in various ways to the support of the Taskforce and the intellectual content and writing of the report. Without their dedication and Herculean efforts this report could not have been completed within the very tight time frames presented to the Taskforce.

This report represents a key point in bringing together evidence and opinions from around the country and from overseas to build a better health care system for Australia. I am therefore very honoured to present to Health Ministers, on behalf of the National Electronic Decision Support Taskforce, the Electronic Decision Support for Australia's Health Sector report.

A handwritten signature in blue ink, appearing to read 'David Brand', with a stylized flourish at the end.

**Dr David Brand**

Chair, National Electronic Decision Support Taskforce  
November 2002



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# LIST OF SHORTENED FORMS

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ACHI	Australasian College of Health Informatics
AHMAC	The Australian Health Ministers' Advisory Council
AIHW	Australian Institute of Health and Welfare
BMMS	Better Medication Management System
CIAP	Clinical Information Access Program
CPRS	Clinical Products Reference Source Project
GPCG	General Practice Computing Group
GPEDS	General Practice Electronic Decision Support
GPs	General practitioners
ICP	Integrated Care Program
NHIMAC	National Health Information Management Advisory Council
NHISAC	National Health Information Standards Advisory Committee
NHMRC	National Health and Medical Research Council
NICE	National Institute for Clinical Excellence
NICS	National Institute of Clinical Studies
NPS	National Prescribing Service
PBS	Pharmaceutical Benefits Scheme
PRODIGY	Prescribing Rationally with Decision Support in General Practice Study
QUM	Quality Use of Medicines
RCT	Randomised Control Trial
UK	United Kingdom
USA	United States of America



# EXECUTIVE SUMMARY

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Electronic decision support systems in the health sector are computer applications that assist clinicians in making decisions about patient care. By assisting health professionals in making important decisions, the systems can contribute to improved safety and quality of health care and ultimately, to improved patient outcomes. Electronic decision support also can improve the efficiency of health care delivery.

Even though there has been substantial work in developing electronic decision support systems in Australia, much of it has been fragmented and uncoordinated, leading to problems of accessibility, scalability, duplication and lack of integration with existing systems.

As an initial step in achieving a coordinated approach to electronic decision support development, the National Health Information Management Advisory Council (NHIMAC) and the National Institute of Clinical Studies (NICS) held a joint workshop on electronic decision support governance in November 2001. The aim was to develop a governance framework and recommendations for action to advance industry delivery of evidence-based decision support systems.

The workshop recommended that a Taskforce be established, under the guidance and direction of NHIMAC, to report to Health Ministers on future directions, including governance arrangements.

This report, prepared by the National Electronic Decision Support Taskforce, considers the benefits and difficulties of adopting a national approach to electronic decision support development in Australia – and makes recommendations about how serious progress can be made in this area in a nationally coordinated way.

## What is electronic decision support?

There are various definitions of what constitutes an electronic decision support system. The Taskforce has adopted the following definition:

Access to knowledge stored electronically to aid patients, carers, and service providers in making decisions on health care.

The Taskforce definition is restricted to clinical decision support systems, principally used by health care providers. The Taskforce acknowledges that it is important for consumers to also have access to high quality information that is evidence-based in electronic decision support systems developed for consumers.

However, discussion of this issue has not been addressed in this report and should be taken up as part of any future work on electronic decision support for the health sector in Australia.

Electronic decision support systems have three main components: knowledge, rules, and software. Knowledge stored electronically includes published clinical practice guidelines, commercial databases, and custom-designed knowledge bases based on expert opinion. Knowledge is translated into active rules used within the electronic decision support system. The software applies the knowledge, rules, and local patient and clinical data, and presents the electronic decision support functionality on the clinician desktop.

Electronic decision support systems vary in complexity. The more complex systems match characteristics of individual patients with a computerised knowledge base and generate patient-specific and situation-specific recommendations.

The systems are usually embedded in other computer applications, such as those used for prescribing and dispensing medicines, electronic health records, and other information systems used in health settings. Ideally, the patient information used in the systems would come from existing electronic sources, such as electronic health records.

## Status of electronic decision support implementation

There are two main areas of electronic decision support activity cited in international literature. The first is the electronic implementation of guidelines to provide guided clinician support during consultations, and therapeutic and patient management recommendations. The second is the implementation of an electronic decision support system to support electronic prescribing of drugs and ordering of medical tests. The focus of these systems is on providing alerts and reminders and critiquing the orders placed by clinicians.

There is a small group of electronic decision support systems currently in use overseas. Several have been in routine use for decades. The majority are single-institution systems that are implemented and maintained in one health care setting, usually a hospital. Typically, the system is developed from some combination of local clinician expertise (including in-house clinical policies and procedures), published clinical guidelines and a review of the published literature.

An inventory of electronic decision support initiatives in Australia identified 35 significant systems in routine use. Almost half the projects are multi-state or national. There are projects in every state and territory; the majority in the more populous states (New South Wales and Victoria). The predominant health care

setting in which the systems are implemented in Australia appears to be primary care. The majority of the systems focus on therapy planning and management. Fewer provide support for diagnosis. The most commonly used knowledge sources were published guidelines and in-house expert opinion. Commercial databases were used in nearly half the systems, primarily in hospital settings.

In Australia, government is the primary driver of electronic decision support. Over two thirds of projects were funded predominantly by government. A small number of projects accounted for the bulk of the investment, and typically these are funded by the Commonwealth Government.

In community-based health services, electronic decision support systems are used in community pharmacies as part of the dispensing process for medicines. New systems that are being rolled out in community health in New South Wales will include some components of electronic decision support.

## Evidence for benefits from using electronic decision support systems

There is substantial evidence of the effectiveness of electronic decision support in improving the safety, quality and efficiency of health care.

Medication errors are recognised as one of the most significant causes of iatrogenic injury, death and costs in hospitals. Electronic decision support, combined with electronic prescribing systems, is an effective strategy for reducing medication errors, including errors that could cause patient harm. Automated alerts can signal the presence or possibility of an adverse drug event for a particular patient. The system can check the prescription for interactions with other drugs already listed in the medical record, check that the dose is in the recommended range, screen for allergies and other medical conditions included in the medical record, and provide alerts for recommended tests and their results.

The systems also have the potential to increase appropriate and safe prescribing decisions by providing information about suggested drug doses and frequency of doses as well as prompts to order particular drugs under specific conditions. Pharmacy-based systems incorporating adverse drug alerts have also been found to be effective in identifying potentially dangerous drug doses or combinations that were referred back to the prescribing physician.

Electronic decision support systems have only recently been directed towards improving the quality of medical care. A leading centre in this field has recently shown that a computer-assisted management program for anti-infective agents led

to significant reductions in orders for drugs to which the patients had reported allergies, as well as reductions in excess drug dosages and antibiotic-susceptibility mismatches. There were also marked reductions in the mean number of days of excessive drug dosage and in adverse events caused by anti-infective agents. These changes were accompanied by significant reductions in drug costs, total hospital costs, and the length of the hospital stay. The availability of such software tools, based on specialist knowledge and up-to-date best-practice therapies, will be useful to all health care providers — especially practitioners in primary care — who frequently manage disease risk factors.

Alerts generated by electronic decision support systems have been shown to result in faster treatment for patients whose medication needed review. Alerts have also been found to increase the proportion of corollary tests ordered in association with prescribed medication. Those systems aimed at providing preventive care reminders have been shown to be reasonably effective in primary care settings.

Electronic decision support systems have also been shown to be able to significantly improve the quality of medical care by helping clinicians comply with ever-changing management guidelines and care standards. There is evidence that electronic decision support can increase compliance with clinical pathways and guidelines and reduce rates of inappropriate diagnostic tests. It can support increased use of evidence by clinicians in direct patient care, resulting in better patient outcomes.

Electronic decision support has the potential to contribute to patient education, practice audit and clinical outcome analysis. These systems provide the opportunity to use data to review clinical practice patterns, such as medications and tests ordered for specific patient groups. This evidence base can be used to review current practice and discuss variations in practice. Feedback to clinicians of data about clinical practice has been shown to have a positive effect on care patterns and cost of care.

While it is expected that the use of the systems would improve efficiency of care by reducing physician time spent on administrative tasks, there is limited evidence of this. The extent to which administrative efficiency is improved depends on multiple factors, such as type of system, types of tasks, professional groups affected and their experience with the system.

There is some evidence of reduced costs associated with electronic decision support implemented in hospitals as part of computerised physician order entry systems. The savings were largely due to the increased use of less expensive tests and drugs, and fewer medication errors and adverse drug events.



## Needs of clinicians and the health information industry — consultation outcomes

The report commissioned by the Taskforce presents the findings of a literature search, consultations and forums with clinicians, representative organisations and the health information industry. The consultation processes with clinicians identified a range of electronic decision support requirements. They are:

- Prescribing and processing of orders using rules based on the guidelines produced by the learned bodies. The status of that knowledge and its date of issue are required at the point of prescribing and ordering, and it must be possible to reconstruct that information when a decision is reviewed retrospectively.
- Access to and use of relevant clinical information about the patient that is derived from other systems, as well as information entered directly as part of the electronic decision support process.
- The production of alerts based on a range of factors, including known allergies, consumer-specific information, and the knowledge rules associated with the conditions and proposed interventions, investigations and medications.
- Prompts and reminders to enhance prevention, recall and reminder processes.
- Information searches of the Cochrane database and other references that may not be contained within the system's knowledge base.
- Diagnosis support at the relevant stage of the consultation, and access to clinical pathways associated with the presenting problem and diagnosis.
- The ability to measure actual practice against peer norms by using indicators at a range of levels, for example, for an individual clinician, for clinicians across a practice, or clinicians across a division or specialty.
- The ability to conduct concurrent as well as retrospective clinical audits.

Clinicians believed that existing governance structures are currently operating in isolation from one another; they should be consolidated in a national approach to the development of electronic decision support systems. Clinicians acknowledged that no organisation currently covered all aspects of the required role, and a broader remit and a re-negotiation of roles would be required.

Consultations with industry covered a variety of leading health solution providers, ranging from small, local operators to large international corporations. Industry believed that greater progress could be made by rigorously applying current standards, using only accredited guidelines and knowledge bases, and adhering to standards for messaging, privacy and security.

Industry supported having a national decision-making body to consolidate national efforts for future investment in health information systems, innovation and sustainability. Industry also believed that current initiatives and investment in electronic decision support systems needed to be coordinated and consolidated. Small investments were not sustainable in the long term; it was more advantageous to identify a small number of key areas over the next 2–3 years and focus on making these a success with a small number of industry partners.

## **Barriers to successful implementation of electronic decision support systems**

A range of issues and challenges need to be addressed before electronic decision support systems can be implemented successfully. These issues include:

- concerns about quality and safety aspects of electronic decision support systems
- gaining acceptance of health professionals
- implementation issues
- level of investment required.

The three main issues associated with quality and safety aspects of electronic decision support systems are content, system and testing issues. Content issues regarding quality and safety concern the quality of the underlying knowledge base used in the systems and the conversion of this knowledge into electronic form. These issues need to be addressed if health professionals are to increase their uptake of the systems.

All systems and processes have a degree of failure. The most likely areas of failure in electronic decision support systems are not yet well known. As the effects are unknown, it is difficult to develop appropriate risk management strategies. The interface between clinicians and system developers is a key concern and needs to be considered in the development of the systems. Their reliability and robustness is paramount.

System standardisation and compatibility are issues that affect quality and safety. In the health sector, for example, medical devices must conform to performance standards, and the actual process of constructing such medical devices must also adhere to quality standards. Few electronic decision support systems in operation in Australia use standard quality processes or quality testing to ensure that the system performed correctly. Consequently, there is generally a lack of testing of such systems in regard to their content, internal processing and delivery of the content, or the production processes.

User acceptance is a significant issue for the development and greater use of electronic decision support systems. Factors that influence user acceptance include: confidence in the system's underlying knowledge base, functionality and availability; their impact on work processes; lack of skills in using them; and concerns about medico-legal issues.

National standards can support the quality, safety, efficiency and effectiveness of the decision support systems used by health care providers in providing services to consumers. By ensuring that the systems are developed according to agreed national standards, industry will be in a better position to develop applications on a commercial scale. At the same time, to maintain Australian competitiveness, standards adopted here should conform to internationally agreed standards that are developed with Australian input.

Greater investment in the infrastructure within health facilities is needed to address clinicians' requirements and ensure quality and safety of the systems. The current estimate of investment levels in information technology in health — between 1 and 3 per cent — falls far short of what is spent in other industries.

Electronic decision support systems will not operate in isolation. In many instances, particularly in hospitals, such systems will inter-operate with a range of other systems, such as patient administration, emergency, pathology and radiology. The issue of interoperability with other systems must be considered in the planning process to ensure sustainability of the systems.

Industry reports that, on the occasions it is asked to undertake information technology projects, it does not have the necessary capacity because of the intermittent nature of funding and the difficulty in retaining staff during lean times. The fragmented nature of the medical software industry also means that there is little capacity to undertake research and development in-house.

## Future directions for electronic decision support in Australia

From the evidence presented above, electronic decision support systems have enormous potential. However, most of this potential has been only partially realised because of the barriers that need to be overcome to implement the systems successfully.

Therefore, the way ahead for the development and increased uptake of electronic decision support applications in Australia will need to address these barriers and promote the development of high quality electronic decision support systems. The Taskforce's view is that this can only be done through national collaboration. A national approach will minimise the potential risks of ad hoc (and therefore probably incompatible) activities and initiatives, and maximise opportunities for achieving greater acceptance and uptake by health professionals.

The Taskforce identified six key areas where work can be undertaken at a national level and have a national impact wherever individual agencies or industry in Australia choose to embark on the development of electronic decision support applications. These areas are:

- **Foster research, development and best practice in the implementation of electronic decision support systems**

There is a great deal of research and development in electronic decision support across the public and private sectors. However, at present there are no formal mechanisms for a nationally coordinated approach to research and development in this area. The Taskforce proposes that a national research and development strategy be developed to help identify where investment in research is best placed.

- **Enhance the quality and safety of electronic decision support systems**

Few systems currently operating in Australia use quality processes or quality testing as part of their development cycle. Consequently, there is a risk that projects will perform unsafely or unreliably in clinical settings. To address this issue at a national level, the Taskforce proposes that a national body take responsibility for the accreditation process to ensure the quality and safety of systems at two key points.

Those points are:

- assessing the suitability of knowledge bases for conversion to an electronic decision support format
- accrediting the clinical integrity of applications.

- **Establish a national standards framework**

Currently, the health information technology market in Australia is small and fragmented. Software developers have little guidance about the standards to adopt. By ensuring that electronic decision support systems are developed

according to agreed national standards, industry will be in a better position to develop applications on a commercial scale. The Taskforce proposes that national standards be developed in the appropriate standards forums as the foundation for developing electronic decision support systems in health.

#### ■ **Encourage an evaluation culture**

Few electronic decision support projects have evaluated their systems in any rigorous or comprehensive manner. Furthermore, there is widespread variation in the evaluation methods chosen, making it very difficult to compare the effectiveness of different systems. Consequently, the bulk of the investment in these systems in Australia remains largely unevaluated. The Taskforce proposes that an evaluation methodology be developed to ensure that electronic decision support systems are evaluated once they are in operation, enabling their performance and effectiveness to be compared. Furthermore, the Taskforce proposes that adequate funding be allocated to evaluating systems once they have been developed.

#### ■ **Encourage uptake and use of electronic decision support systems**

The Australian health care system is moving towards a more integrated and coordinated approach to care and placing greater emphasis on evidence-based decision making. The role of information technology in day-to-day clinical practice is becoming increasingly important for accessing and communicating health-related information. One of the major impediments to accelerating the uptake of information technology in the clinical workplace, however, is a lack of support and training for individual practitioners in the use of computer hardware and software applications. Another significant factor is the role of organisational culture in facilitating and supporting the use of electronic decision support by clinicians. These key areas are as relevant to the wider health information agenda as they are to electronic decision support. The Taskforce proposes collaboration with others seeking to advance the health information capacity in the sector and to encourage and support a range of capacity-building initiatives.

#### ■ **Establish national coordination and governance arrangements**

The Australian health care system is fragmented. Services straddle the private and public sectors and there are different delivery mechanisms in various parts of the country. Much of the work on health-related online technologies has been carried out in isolation from similar efforts elsewhere. The Taskforce proposes a national approach by registering projects, building partnerships and collaborating to achieve economies of scale and integration with other key areas of activity.

Specific recommendations relating to each of these areas are summarised on pages 12–14 and expanded in chapter 8.

## Implementation of the National Action Plan and governance arrangements

The development of electronic decision support systems needs to be planned carefully. The Taskforce proposes a two-stage approach to implementation. Stage 1 is intended to establish many of the foundations needed if electronic decision support systems are to be developed in a more consistent and coordinated way. Stage 1 focuses on establishing the environment in which all stakeholders can operate.

The Taskforce believes that work should proceed immediately on Stage 1 (which includes developmental activities outlined in the National Action Plan) and that, as a transitional arrangement, a National Implementation Unit be created and jointly resourced and staffed by the Commonwealth, states and territories. The role of the unit would be to commence work on Stage 1 of implementation without committing resources on a scale that will require budget appropriations. The Taskforce considers that the National Institute of Clinical Studies (NICS) would be the most appropriate body to project-manage the work of the interim National Implementation Unit for the first two years.

Stage 2 is to put the full National Action Plan into operation. At this point, adopting an accreditation process would realise the most gains in improving the safety and quality of the knowledge bases underpinning electronic decision support systems. Accreditation will require a national body. Accreditation would cover how the rules-based knowledge is incorporated into the range of computer systems in the Australian electronic decision support systems marketplace.

The Taskforce is mindful of the processes currently under way at the national level to review the governance framework for the health information agenda more generally. The outcomes from these processes would need to be considered before a final recommendation can be made about whether an existing national body can take on the responsibility of managing and coordinating electronic decision support development, or a new national body needs to be created. Therefore, the Taskforce recommends that the longer-term governance arrangements be confirmed within the next year once the broader national governance issues are resolved.

## Benefits and costs of implementation

Electronic decision support is seen as a key mechanism to enable health professionals to provide high-quality health services to consumers. It is expected that electronic decision support systems designed to aid health care providers when making important decisions will ultimately improve patient outcomes.

Overall, the available evidence of the systems' ability to improve the quality, safety and efficiency of health care is promising. However, there remains a need to continue to monitor and evaluate the implementation of electronic decision support systems in order to build the evidence base and to ensure their full potential is realised.

While the Taskforce believes more work is required, it also considers that it is time to invest in this area immediately.

Furthermore, experience with other health information initiatives has shown that government is best placed to bring about change and accelerate the pace of reform, in partnership with key stakeholders. Acting collaboratively, Commonwealth, state and territory governments represent a powerful agent for change. For the next phase of national activity, funding is required for the following components:

- **Governance.** This includes the costs associated with running the National Implementation Unit and its secretariat to coordinate and manage the development activity and to oversee the implementation of Stage 1 of the National Action Plan.
- **Development costs.** These include the development of key deliverables, such as the standards, a research and investment plan, an evaluation methodology, and communications materials.
- **Implementation costs.** These include costs of implementing aspects of the National Action Plan, such as the accreditation agency that will be in place in the longer term.

The overall indicative costs for implementing the National Action Plan over two years (that is, from July 2003 until June 2005) are estimated at \$2.7 million, of which \$1.135 is estimated for the 2003–04 financial year and \$1.565 is estimated for the 2004–05 financial year. Clearly, the cost estimates are sensitive to assumptions made and can be further refined as detailed planning is undertaken.

This report does not attempt to quantify the savings that could be realised in the health sector from the greater use of electronic decision support systems. However, it is clear that significant savings could be achieved just by reducing medication errors. If, for example, the inappropriate use of medicines in public hospitals were reduced by only one per cent through the use of electronic decision support systems, the expected savings would be around \$3.8 million per annum.



# TABLE 1 SUMMARY OF RECOMMENDATIONS

Strategic Priority Area	Objectives	Recommendations for Action
<b>1 Foster research, development and best practice in the implementation of electronic decision support systems</b>	<ul style="list-style-type: none"> <li>■ Set a national research agenda and priorities for electronic decision support systems development in Australia.</li> <li>■ Develop standard best-practice models for converting clinical knowledge into electronic form.</li> <li>■ Encourage greater collaboration between government, consumers, academia and industry.</li> </ul>	<p><b>1</b> A national research and investment strategy be developed for electronic decision support systems implementation by end 2003 that:</p> <ul style="list-style-type: none"> <li>■ identifies appropriate national priorities for work</li> <li>■ includes a plan on how to prioritise investment to undertake this work</li> <li>■ includes a statement of national strategic directions to assist industry with its business planning</li> <li>■ is cognisant of current priorities of governments that are related to electronic decision support for healthcare providers and consumers, including in the following areas: <ul style="list-style-type: none"> <li>● quality use of medicines, pathology, radiology and interventions</li> <li>● electronic decision support systems development for general practice</li> <li>● rules based order management for hospitals</li> <li>● call centres</li> <li>● provision of access to online clinical information (eg CIAP)</li> <li>● development of clinical pathways, algorithms, etc. for national priority areas.</li> </ul> </li> </ul> <p><b>PRIORITY – High</b></p>
		<p><b>2</b> Standard best-practice models be developed to assist in assessing whether clinical knowledge is suitable for conversion to electronic form — end 2003.</p> <p><b>PRIORITY – High</b></p>
		<p><b>3</b> A regulatory framework be established that allows for the development of sustainable business models by health information industry participants.</p> <p><b>PRIORITY – Medium</b></p>
		<p><b>4</b> A program be initiated that encourages collaborative research projects between government, consumers, academia and industry — June 2004.</p> <p><b>PRIORITY – Medium</b></p>
<b>2 Enhance the quality and safety of systems</b>	<ul style="list-style-type: none"> <li>■ Ensure the development of quality electronic decision support systems that perform accurately and safely in a clinical environment.</li> </ul>	<p><b>5</b> A framework of standards and procedures be developed by end 2003 for accrediting particular clinical knowledge bases.</p> <p><b>PRIORITY – High</b></p>
		<p><b>6</b> A formal process be established by mid 2004 to accredit desktop software whereby a recognised body would perform a specified level of testing against predefined criteria and standards, including in the following areas:</p> <ul style="list-style-type: none"> <li>■ adherence to technical standards</li> <li>■ conformance with standards for development</li> <li>■ adherence to standards for functionality testing</li> <li>■ conformance with standards for re-accreditation</li> </ul> <p><b>PRIORITY – High</b></p>
		<p><b>7</b> A priority list of medication alerts be developed for use in electronic decision support systems in a range of clinical settings — by end 2003.</p> <p><b>PRIORITY - High</b></p>
		<p><b>8</b> All government funded projects to adopt best-practice standards — by mid 2004.</p> <p><b>PRIORITY – High</b></p>
		<p><b>9</b> A register of accredited clinical knowledge bases be established — by end 2004.</p> <p><b>PRIORITY – Low</b></p>



Strategic Priority Area	Objectives	Recommendations for Action
<b>3 Establish a standards framework</b>	<ul style="list-style-type: none"> <li>Facilitate the development and uptake of standards to enable electronic decision support.</li> <li>Support the development of partnerships between the health IT sector and developers of clinical knowledge.</li> <li>Ensure (where possible) that standards adopted in Australia align with international standards.</li> </ul>	<p><b>10</b> Agreement be gained among key stakeholders on the detailed requirements for clinical knowledge representation methodologies to facilitate the representation of clinical guidelines, rules and protocols in electronic software — by end 2003. <b>PRIORITY – High</b></p> <p><b>11</b> NHISAC and associated standards-making bodies ensure that the needs of electronic decision support in relation to standards development are taken into account in developing standards policies and projects — ongoing. <b>PRIORITY – High</b></p> <p><b>12</b> The Taskforce’s recommendations concerning standards development for electronic decision support be taken up in the next edition of the National Health Information Standards Plan for Australia — end 2003. <b>PRIORITY – Medium</b></p> <p><b>13</b> Australian participation be facilitated in the development of standards for clinical knowledge representation, which is largely being undertaken internationally — ongoing. <b>PRIORITY – Low</b></p>
<b>4 Encourage an evaluation culture</b>	<ul style="list-style-type: none"> <li>Evaluation of efficacy of electronic decision support systems is undertaken as a matter of course and uses a rigorous and validated methodology.</li> </ul>	<p><b>14</b> An evaluation methodology be developed to ensure that evaluations use rigorous and validated methods and that their results are robust and permit across-project comparisons — by end 2003. <b>PRIORITY – High</b></p> <p><b>15</b> Make evaluation a required component of any government funded electronic decision support program, including ensuring that sufficient funds are set aside to adequately resource such evaluation — by end 2003. <b>PRIORITY – High</b></p>
<b>5 Encourage uptake and use of electronic decision support systems</b>	<ul style="list-style-type: none"> <li>Foster increased participation by consumers and providers in the use and uptake of quality electronic decision support systems.</li> <li>Support the development and delivery of community information, education and training to inform and educate consumers and providers in the use of electronic decision support systems.</li> </ul>	<p><b>16</b> A study be undertaken on the extent of use of current systems and the barriers to the use of such systems — by end 2003. <b>PRIORITY – Medium</b></p> <p><b>17</b> A review be undertaken on the impact that electronic decision support systems have on the day-to-day workflow of health professionals and best practice models be developed to assist them to improve workflows and work practices — by end 2003. <b>PRIORITY – High</b></p> <p><b>18</b> The inclusion of training in the use and evaluation of electronic decision support be promoted in health-related undergraduate and post-graduate courses by liaising with university departments, colleges and professional associations — by end 2003. <b>PRIORITY – Medium</b></p> <p><b>19</b> A national communications strategy be implemented to encourage uptake of electronic decision support systems, including the development of a community information strategy and national communications materials — by end 2003. <b>PRIORITY – Medium</b></p> <p><b>20</b> Electronic decision support be promoted to learned bodies in the health sector — by end 2003. <b>PRIORITY – Low</b></p>

Strategic Priority Area	Objectives	Recommendations for Action
<b>6 Establish national coordination and governance arrangements</b>	<ul style="list-style-type: none"> <li>■ Coordinate the strategic direction, vision and policy recommendations on behalf of governments through AHMAC and Health Ministers.</li> </ul>	<p><b>21</b> Coordination between electronic decision support project teams be encouraged by establishing a strategic governance entity — by mid 2003. <b>PRIORITY – High</b></p>
	<ul style="list-style-type: none"> <li>■ Increase necessary synergies among jurisdictions by sharing resources and reducing unnecessary duplication of effort.</li> </ul>	<p><b>22</b> A clearinghouse of electronic decision support projects be established by end 2003 that:</p> <ul style="list-style-type: none"> <li>■ maintains a bibliography of reports on projects in Australia</li> <li>■ details new projects and significant investments made in electronic decision support systems</li> <li>■ provides evaluation reports to disseminate information about the efficiency and effectiveness of electronic decision support projects</li> <li>■ lists professional experts in key areas.</li> </ul> <p><b>PRIORITY – Medium</b></p>
	<ul style="list-style-type: none"> <li>■ Encourage communication between existing and new players with an interest in electronic decision support systems development.</li> </ul>	<p><b>23</b> An annual electronic decision support forum or conference be held to encourage interaction amongst stakeholders, to share experiences and to encourage the building of networks. <b>PRIORITY – Low</b></p>
<hr/>		
<b>7 Governance</b>		<p><b>24</b> Immediately commence work to progress the recommendations for action set out in the National Action Plan (chapter 8). <b>PRIORITY – High</b></p> <p><b>25</b> Pending approval from the Board, establish an interim National Implementation Unit located within the National Institute of Clinical Studies (NICS) to be responsible for managing and coordinating the implementation of the National Action Plan. <b>PRIORITY – High</b></p> <p><b>26</b> The National Implementation Unit to review the longer-term governance requirements necessary for ensuring a nationally coordinated approach to the development of electronic decision support systems by end 2003 — having regard to other processes that are currently in train that concern national governance arrangements for health information issues. <b>PRIORITY – Medium</b></p>

# **Part A**

## **Background and context**



# 1 NATURE OF THE REPORT

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## 1.1 Background

Australian Health Ministers are committed to improving the delivery of health services and achieving better outcomes in health care through the use of information and communications technologies. To this end, the National Health Information Management Advisory Council (NHIMAC) was established by Health Ministers in July 1998 to develop a national plan of action for information management in the health sector. *Health Online: A Health Information Action Plan for Australia* was first launched in November 1999, with the second edition (NHIMAC 2001) released in September 2001.

A key strategy in *Health Online: A Health Information Action Plan for Australia* is to:

Expand the development of decision support services, through the establishment of a coherent approach to the development of decision-support systems and electronic clinical resources for health professionals and to bring new decision-support services into operation.

In particular, Health Online proposes the need to:

- gain agreement to a coordinated approach from key stakeholders
- identify the key priority areas of decision support that major user groups will want to adopt in the foreseeable future
- devise an action plan for the development of specific decision support services.

Clinicians are overloaded with information on new drugs, new guidelines for preventing, diagnosing and managing conditions, and software packages to improve prescribing and streamline their practice administration. The advent of electronic decision support systems is an important development with the potential to assist clinicians and consumers in accessing research evidence on best-practice health care at the point of care.

Even though there has been substantial development work in the systems in Australia, much of it has been fragmented and uncoordinated, leading to problems of accessibility, scalability, duplication and lack of integration with existing systems.

Already, a number of electronic decision support projects have been initiated. In September 1999, the General Practice Computing Group (GPCG) auspiced a General Practice Electronic Decision Support Workshop, which aimed to identify decision

support solutions for prevention, chronic disease management and prescribing in general practice. Furthermore, the National Prescribing Service auspiced a decision support workshop focussed on decision support systems for electronic prescribing. Clearly, there is still a need for an overarching governance arrangement for decision support that covers the full spectrum of stakeholders, including industry and providers.

As an initial step toward achieving a coordinated approach to electronic decision support development, NHIMAC jointly held a workshop with the National Institute of Clinical Studies (NICS) in November 2001 on electronic decision support governance. The aim of the workshop was to develop a governance framework and recommendations for action that would allow for the advancement of industry delivery of evidence-based decision support systems. The workshop participants reached agreement about the need for a national governance arrangement to ensure the development of sustainable, nationally integrated systems. They supported the recommendation that a single national entity, close to Health Ministers, be established to coordinate development of electronic decision support systems in health care settings. The workshop also recommended that a Taskforce be established, under the guidance and direction of NHIMAC, to report to Health Ministers within a short timeframe to provide advice on future directions for electronic decision support, including governance arrangements.

NHIMAC considered the report from the workshop (NHIMAC & NICS 2002) at its meeting on 23 January 2002. Based on the recommendations in the report, NHIMAC members agreed unanimously to the establishment of a National Electronic Decision Support Taskforce, under its guidance and direction. The Australian Health Ministers' Advisory Council (AHMAC) supported the establishment of a Taskforce in February 2002. The Taskforce was formed in May 2002.

The membership structure for the Taskforce was broadly based, covering both private and public sector interests, including representation from all jurisdictions. A listing of Taskforce Members is included at page ii. Support for the Taskforce was provided by the Commonwealth Department of Health and Ageing.

## 1.2 Taskforce objectives

The National Electronic Decision Support Taskforce was asked to consider the benefits and difficulties of adopting a national approach to electronic decision support development in Australia and to set future directions for electronic decision support, including governance arrangements.

The key objectives of the Taskforce were to:

- identify, at a national level, the work program and national governance arrangements required to ensure the development of sustainable, nationally integrated electronic decision support system
- gain wide support for a nationally coordinated approach to the development of electronic decision support systems from key stakeholders
- recommend a way ahead to Australian Health Ministers in sufficient detail to enable them to make decisions and commit resources.

### 1.3 Explanation of approach

The approach adopted by the Taskforce was to inform itself of the merits of introducing a national approach to electronic decision support by two principal means. These were:

- Commissioning two consultancies to research and report on electronic decision support systems requirements and electronic decision support activities in different healthcare settings in Australia, as follows:

Electronic decision support systems requirements

- undertake a review of existing literature to determine the needs of industry and clinicians in relation to decision support information
- undertake individual consultations and focus group meetings with the aim of exploring more in depth issues which are of particular importance to these stakeholder groups
- analyse the collected information and describe the key issues impacting on: industry's ability to develop electronic decision support systems in a competitive market place and clinicians' use and take-up of decision support information/systems.

Electronic decision support activities in different healthcare settings in Australia

- detail the current status of electronic decision support implementation world-wide, identifying those in operation, the audience for those systems, the information provided by the systems, the sources of that information, the commercial nature of the projects, implementation and take-up issues and the governance arrangements for the management of those systems
- prepare an inventory of large-scale and/or significant electronic decision support activities, including related expenditure in Australia
- review existing literature to assess whether electronic decision support systems can effectively improve clinical outcomes

- identify the critical issues or factors that can impact on the successful implementation of electronic decision support systems
  - determine the benefits and difficulties of a nationally coordinated approach to electronic decision support systems in Australia.
- Relying on its own research and the considerable expertise and experience of Taskforce members.

## 1.4 Structure of the report

The report itself is divided into three parts. These are as follows:

- Part A** sets the scene with background and context concerning electronic decision support systems, describing the benefits and barriers to the successful implementation of such systems.
- Part B** contains the Taskforce's discussion of issues and its specific recommendations.
- Part C** comprises supporting material on which the report has drawn, including specially commissioned work.

## 2 WHAT IS ELECTRONIC DECISION SUPPORT?

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### 2.1 Definition of electronic decision support

Electronic decision support systems in the health sector are computer applications that assist clinicians in making decisions about patient care. They are designed to aid health professionals by providing assessments or prompts that are specific to individuals and are selected from a knowledge base according to their characteristics. The systems offer the potential to make an important contribution to the quality of health care by providing consumers with ‘just-in-time’ notification of best practice or possible adverse effects, and clinicians with access to relevant, evidence-based information at the point of care (Delaney et al. 1999).

There are various definitions of just what constitutes an electronic decision support system. The Taskforce has adopted the following definition of electronic decision support:

Access to knowledge stored electronically to aid patients, carers, and service providers in making decisions on health care.

The Taskforce definition is restricted to clinical decision support, that is, the decisions made by health care professionals (eg physicians, nurses, allied health practitioners) in relation to patient diagnosis, treatment and care. The scope of the Taskforce’s work is electronic decision support across the entire health and aged care sectors, including general practice, allied health, community health, hospitals and residential aged care.

The Taskforce acknowledges that it is important for consumers to also have access to high quality information that is evidence-based in electronic decision support systems developed for consumers. However, discussion of this issue has not been addressed in this report and should be taken up as part of any future work on electronic decision support for the health sector in Australia.

The literature identifies a number of other definitions of clinical decision support, including the following.

- A clinical decision support system compares patient characteristics with a credible knowledge base and then guides a clinician by offering patient-specific and situation-specific advice. By incorporating evidence-based guidelines and a



summary of the patient's data, or knowledge base, the clinical decision making process is enhanced, thereby potentially improving the quality of care (GPCG 1999).

- Clinical decision support allows caregivers to identify the most appropriate treatment based on outcomes assessment and best practice development. These systems focus on improving clinical care by providing timely access to literature, test interpretations, determination of drug dosages, automated warnings and alerts, practice guidelines, and decision analysis (Remmlinger 2002).
- Clinical decision support is any software that directly aids clinical decision making in which characteristics of individual patients are matched to a computerised knowledge base for the purpose of generating patient-specific assessments or recommendations that are then presented to clinicians for consideration (Hunt et al. 1998).
- Clinical decision support or 'expert systems' are computer software systems that are designed to aid clinical decision-making. Computerised decision support provides assessments of prompts specific to the patient and selected from a knowledge base on the basis of individual patient data. At its simplest, this will include programs that suggest alternatives for treatment or diagnosis on the basis of a simple algorithm. More complex systems model the likelihood of future events and the effectiveness of proposed interventions based on individual patient data and 'knowledge' of risks and the effectiveness of interventions (Delaney et al. 1999).

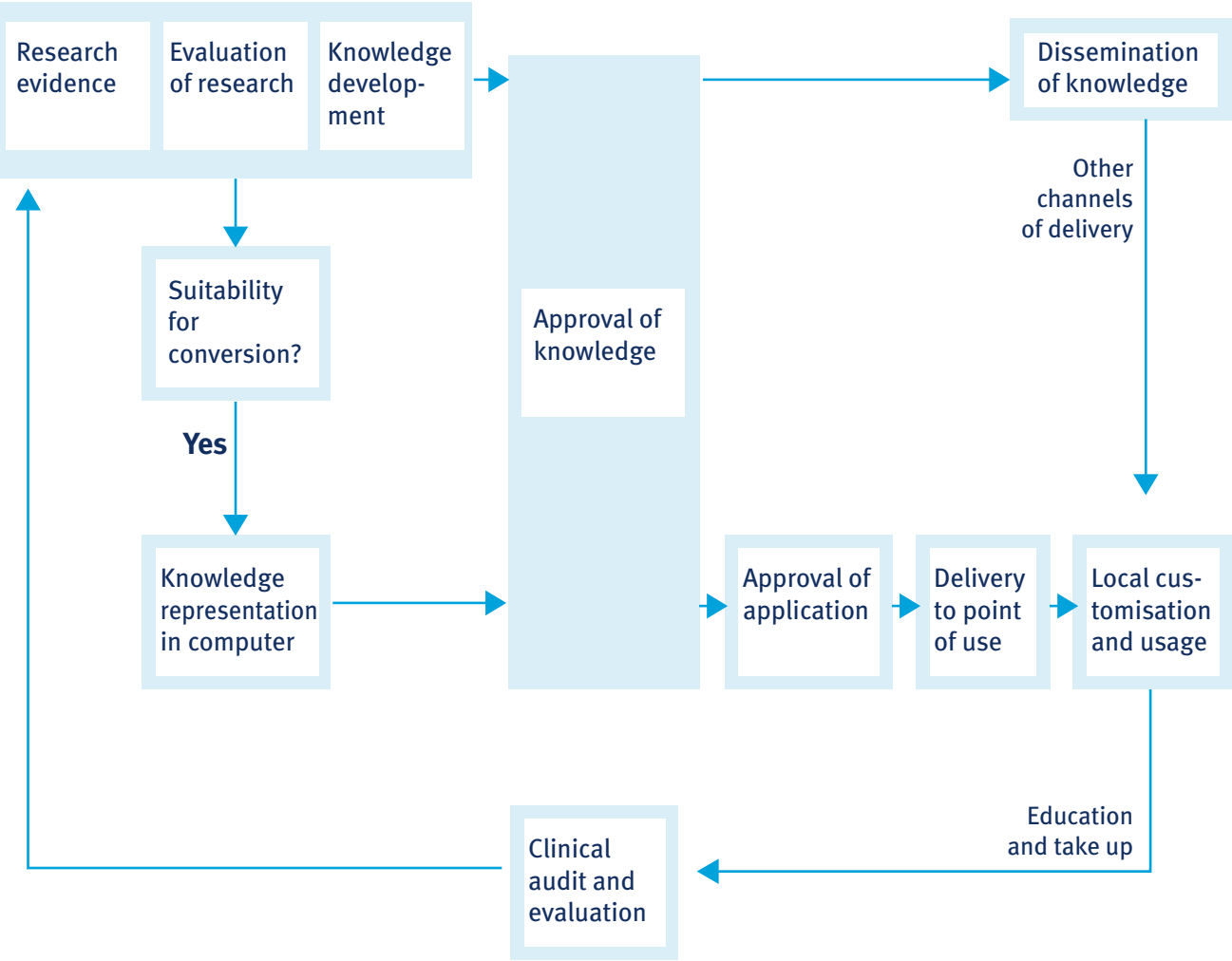
Whatever the definition used, Delaney et al. (1999) suggest that 'computerised decision support systems are a rapidly advancing and unregulated field, with potential for harm as well as benefit if systems are poorly designed and inadequately evaluated'.

## 2.2 Clinical knowledge process

Electronic decision support systems have three main components: knowledge, rules, and software. Knowledge stored electronically includes published clinical practice guidelines, commercial databases, and custom-designed knowledge bases, based on expert opinion. Knowledge is translated into active rules used within the system. The software applies the knowledge, rules, and local patient and clinical data, and presents the electronic decision support functionality on the clinician's desktop.

Figure 1 depicts the clinical knowledge process, commencing with the initial research findings, and ending with its delivery to clinicians at the point of care.

**FIGURE 1: Clinical knowledge process**



Source: National Electronic Decision Support Taskforce

Figure 1 describes the process of knowledge generation, its approval for delivery to the clinical setting, and its dissemination and customisation to the clinical setting. Following education and adoption, ongoing audit provides feedback to allow for such knowledge to be refined, extended and enhanced.

With regard to electronic data systems, figure 1 depicts the need to consider the suitability of knowledge for computerisation during its creation. If considered suitable, the representation of such knowledge is determined in part by its end form (eg an electronic data system for use in clinical care). This may well be an early activity, at times (as shown) occurring before research and approval is completed.

Regardless of whether such knowledge is destined for delivery in traditional forms (paper-based guidelines, patient information material, or published research) or in a computerised format, there is a common need for knowledge to be ratified by its developers (depicted as ‘Approval of knowledge’).

Following such approval, the process of computerisation adds a further requirement to determine that the translation of knowledge into an electronic data system has faithfully maintained its original intent. Delivery of this now approved, computerised form carries its own issues regarding delivery to the point of use (Is a CDROM appropriate? What is the role of on-line delivery such as the Internet?).

Common to either traditional or computerised approaches, figure 1 also depicts the need for local customisation and attention to useability. Common to both approaches is the need for education and ongoing evaluation to determine the effectiveness of usage, which closes the process to inform further research, evaluation and development.

While figure 1 describes the need to consider suitability and likely representation of new knowledge before its ratification/approval, this is not mandatory and may not always be practicable. Rather, the figure aims to communicate the following key points.

- The approval of new knowledge for delivery into the clinical setting is a common feature of both computerised and traditional forms of delivery. The development of electronic data systems adds the need to consider, early in the process, the suitability of new knowledge for computerisation and, therefore, the representation of such knowledge.
- The ultimate form of delivery of new knowledge to the clinical setting in part determines the manner in which such knowledge is developed. For example, to computerise new evidence that has been developed for delivery in a paper-based format predetermines the nature of the electronic data system that will be created. This may not be appropriate and may result in the creation of little more than a computerised 'book' unlikely to be significantly used within the clinical environment.
- Electronic data systems add the requirement to ensure that the computerisation of knowledge has stayed true to its original intent.
- The process is an ongoing one whereby the use of new knowledge in care is continually evaluated in an ongoing fashion to inform further development.

## 2.3 Types of electronic decision support systems

Electronic decision support systems vary in complexity. The more complex systems match characteristics of individual patients with a computerised knowledge base and generate patient-specific and situation-specific recommendations. Systems that generate conclusions from patient data typically utilise knowledge-based technologies.

The Taskforce has adopted the following four-type classification system for electronic decision support (NHIMAC & NICS 2002).

- **Type One.** Provides categorised information that requires further processing and analysis by users before a decision can be made.
- **Type Two.** Presents the clinician with trends of patients' changing clinical status and alerts clinicians to out-of-range assessment results and intervention strategies. Clinicians are prompted to review information related to the alerts before arriving at a clinical decision.
- **Type Three.** Uses deductive inference engines to operate on a specific knowledge base and automatically generates diagnostic or intervention recommendations based on changing patient clinical condition, with the knowledge and inference engines stored in the knowledge base.
- **Type Four.** Uses more complex knowledge management and inference models such as case management reasoning, neural networks<sup>1</sup>, or statistical discrimination analysis to perform outcome or prognostic predictions. Such systems possess self-learning capabilities and use fuzzy set formalism<sup>2</sup> and similarity measures or confidence level computation as mechanisms to deal intelligently and accurately with uncertainty.

Ideally, the patient information used in electronic decision support systems would come from existing electronic sources such as electronic health records. Issues relating to patient information in electronic health records are not part of the scope of the work of the Taskforce, but are being addressed by other initiatives such as *HealthConnect*<sup>3</sup> and the Better Medication Management System.<sup>4</sup>

Electronic decision support systems are usually embedded in other computer applications such as those used for prescribing and dispensing medicines, electronic health records, and other information systems used in health settings. While electronic decision support can be embedded in medical instruments such as electrocardiographs and lung function recorders, this type of specific application is not included in the scope of the work of the Taskforce.

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<sup>1</sup> Artificial neural networks are collections of mathematical models that emulate some of the observed properties of biological nervous systems and draw on the analogies of adaptive biological learnings.

<sup>2</sup> Fuzzy set formalism is a system that is designed to mathematically represent uncertainty and vagueness and provide formalised tools for dealing with the imprecision intrinsic to many problems. It resembles human reason in its use of approximate information and uncertainty to generate decisions.

<sup>3</sup> *HealthConnect* is the proposed national health information network for Australia. Two years of research and development work are currently under way on the *HealthConnect* project.

<sup>4</sup> The Better Medication Management System will enable the creation of a centralised electronic medication record linking prescriptions written by different doctors and dispensed by different pharmacies.

## 2.4 The purpose of electronic decision support systems

Electronic decision support systems are designed to assist health professionals with clinical decision-making in the normal course of their duties. As the volume of published clinical information grows exponentially, it is becoming increasingly difficult for health professionals to update their knowledge. They are subjected to significant information overload, with knowledge from many sources arriving in many different formats. Electronic decision support offers health professionals a means to rapidly access clinical information at the point of care.

Electronic decision support systems can be applied to many different types of clinical task. Some of these include:

- *Generating alerts and reminders.* In real-time situations, an electronic decision support system attached to a monitor can warn of changes in a patient's condition. It can also warn the prescriber at the time of generating an order for a drug that there is a contraindication with the patient's medical condition and an interaction with a current medication. In less acute circumstances, it might scan laboratory test results or drug orders and send reminders or warnings through an e-mail system.
- *Diagnostic assistance.* When a patient's case is complex, rare, or the person making the diagnosis is simply inexperienced, an electronic decision support system can help come up with likely diagnoses based on patient data.
- *Therapy critiquing and planning.* Systems can either look for inconsistencies, errors and omissions in an existing treatment plan, or can be used to formulate a treatment based upon a patient's specific condition and accepted treatment guidelines.
- *Agents for information retrieval.* Software 'agents' can be sent to search for and retrieve information, for example on the Internet, which is considered relevant to a particular problem. The agent may contain knowledge about its user's preferences and needs, and may also need to have medical knowledge to be able to assess the importance and utility of what it finds.
- *Image recognition and interpretation.* Many medical images can now be automatically interpreted, from X-rays through to more complex images like angiograms, CT and MRI scans. This is of value in mass-screenings, for example, when the system can flag potentially abnormal images for subsequent detailed human attention.

## 2.5 Criteria for clinically useful electronic decision support systems

Much has been written about electronic decision support and there is a strong convergence of thinking about what makes for useful decision support systems. Payne writes that ‘clinicians are more likely to use electronic decision support systems if they give patient-specific recommendations, save time, and are incorporated into the workflow of clinic, office or hospital’ (Payne & Thomas 2000).

Some of the most important features of an electronic decision support system identified by health professionals are (Trilogy Information Solutions 2002):

- the processing of orders using rules based on the guidelines produced by the learned bodies. The status of that knowledge and its date of issue are required at the point of ordering as well as its reconstruction when a decision is reviewed retrospectively
- access to and use of relevant clinical information on the patient derived from other systems as well as information directly entered as part of the electronic decision support process
- the production of alerts based on a range of factors, including known allergies and consumer-specific information, and the knowledge rules associated with the conditions and proposed interventions, investigations and medications
- the availability of the evidence behind the decision support rules
- prompts and reminders to enhance prevention, recall and reminder processes
- information searching of the Cochrane database and other references that may not be contained within the knowledge base of the electronic decision support system
- diagnosis support at the relevant stage of the consultation
- access to clinical pathways associated with the presenting problem and diagnosis
- the ability to measure actual practice against peer norms through indicators at a range of levels, for example, for an individual clinician, for clinicians across a practice, or clinicians across a division or specialty
- the ability to conduct concurrent as well as retrospective clinical audits.

## 3 STATUS OF ELECTRONIC DECISION SUPPORT IMPLEMENTATION

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### 3.1 International experience

There are a growing number of reports of electronic decision support systems in the international academic literature. The systems are being applied in a wide number of areas, including hepatic surgery, treatment of hypertension, diagnosis of chest pain, management of tuberculosis, asthma, diabetes, and chronic pain (see Sintchenko report at Appendix A).

There are two main areas of reported activity in the literature. The first is the electronic implementation of guidelines to provide guided clinician support during consultations and therapeutic and patient management recommendations. The second is the implementation of an electronic decision support system to support the electronic prescription of drugs and medical tests. These systems focus on providing alerts and reminders, and critiquing the orders placed by the clinicians.

The systems implemented consist primarily of rule-based systems linked to a knowledge base. Most systems also linked to an electronic patient record in order to provide customised alerts, reminders and therapeutic recommendations. Most of the systems described in the literature are systems at Type 2 or Type 3 of the four types described in section 2.3. Clinical trials of Type 4 systems are rarely reported in the literature, despite the large body of literature describing the technology of such systems (table 1).

**TABLE 1    Type of electronic decision support systems reviewed**

Type	Percentage
Type 1	16.36%
Type 2	20.00%
Type 3	60.00%
Type 4	3.64%

Literature dealing with Type 4 systems tends to detail the construction of systems, rather than their evaluation in a clinical setting. For example, Atienza et al. (2000) used a simple neural network to assess one-year prognosis in 132 heart failure patients, by classifying them into three groups: death, re-admission and one-year



event-free survival. The accuracy of one-year prognosis was 93.2 per cent, with only nine individuals misclassified. However, no comparison was made to current classification rates of experts, nor was the system given to physicians to use. As a result, no conclusions were drawn about the effect of the system on clinical practice or patient outcomes.

Hospitals are the most common setting for the studies. For some studies, clinicians use the electronic decision support system in a laboratory setting. In these studies, clinicians are given patient case studies and asked to diagnose and/or treat the patient with or without the aid of the system and the results are compared. Most of the remainder are conducted in primary care (table 2).

**TABLE 2      Settings in which reviewed electronic decision support systems are implemented (N=55)**

Setting of projects	Percentage
Hospital	54.55%
Laboratory	21.82%
Primary care	16.36%
Hospital pharmacy	3.64%
Specialist rooms	1.82%
Community pharmacy	1.82%

Almost all electronic decision support systems are developed at the particular research institution. The knowledge bases incorporated in the systems are usually developed using in-house expertise. Typically, the system is developed from some combination of local clinician expertise (including in-house clinical policies and procedures), published clinical guidelines and a review of the published literature (table 3).

**TABLE 3      Percentage of studies that used commercial, in-house and published data to design the electronic decision support systems**

Resource	Percentage
Commercial database	1.82%
In-house data	61.82%
Published data	45.45%

In terms of evaluation, the studies are specific to the implementation setting. Each of the systems is different in terms of clinical (disease specific) application, interface useability, procedures and method of use, point of application in the clinical care



pathway, level of electronic decision support systems hardware and software integration into the existing infrastructure, etc. This complete lack of standardisation in system or methodology means that it is difficult to make any direct comparisons between systems.

## Electronic decision support systems operating overseas

A search of international literature and web-based resources identified a small group of electronic decision support systems currently in use overseas (table 4). Several systems have been in routine use for decades. All provide Type 2, Type 3 and Type 4 decision support. The majority of systems in use are single-institution systems implemented and maintained in one health care setting.

Prescribing Rationally with Decision Support in General Practice Study (PRODIGY) is a rare example of a nation-wide deployment of an electronic decision support system, supporting prescribing decisions in general practice in the United Kingdom. PRODIGY offers clinical management advice following a diagnosis, including prescribing and non-drug advice, doctor/patient shared screens, patient information leaflets, advice on when to refer and when to investigate, and reference and learning materials for use outside the consultation. Prescribing advice includes a choice of three or more drug treatments as well as non-drug treatments. Upon selection of a drug, the system provides appropriate dosage information, and checks for allergies, contraindications and interactions.

The management of PRODIGY rests with the National Institute for Clinical Excellence (NICE). NICE's remit is to provide patients, health professionals and the public with authoritative, robust and reliable guidance on current 'best practice'<sup>5</sup>, although its role is far wider than just the management of PRODIGY.

Clinical content for PRODIGY is provided by the Sowersby Institute of Health Informatics<sup>6</sup> under contract to NICE. Accreditation of clinical content involves extensive clinical evaluation by recognised experts. Clinical content is updated regularly in line with changing best practice. A new web-enabled consultation and validation process is being developed to speed up the process of validating new clinical material for inclusion within PRODIGY.<sup>7</sup>

The National Guideline Clearance House in the United States<sup>8</sup> is a rare example of a system with international reach, although it is only marginally classifiable as a Type 1 electronic decision support system.

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<sup>5</sup> [www.nice.org.uk](http://www.nice.org.uk)

<sup>6</sup> [www.schin.ncl.ac.uk](http://www.schin.ncl.ac.uk)

<sup>7</sup> [www.prodigy.nhs.uk/clinicalguidance/consultationandvalidationprocess.asp](http://www.prodigy.nhs.uk/clinicalguidance/consultationandvalidationprocess.asp)

<sup>8</sup> [www.guideline.gov/index.asp](http://www.guideline.gov/index.asp)

**TABLE 4 Examples of electronic decision support systems currently in use overseas (Sintechenko et al. 2002)**

Name of a system	Health care setting	Year commissioned
HELP (Health Evaluation Through Logical Processing)	LDS Hospital, Salt Lake City, Utah, USA	1980
Electronic Medical Records	Department of Veteran Affairs Medical Center, Washington DC, USA	1990
ADE (Adverse Drug Event) Monitor	Barnes Hospital, St. Louis, Missouri and Washington University School of Medicine, USA	1995
Colorado Medical Utilisation Review System	Colorado Health Centre, Denver, USA	1990
GermAlert and GermWatcher	Barnes Hospital, St. Louis, Missouri, USA	1993
DoseChecker	Barnes Hospital, St. Louis, Missouri, USA	1994
DXplain (Diagnostic decision support in general medicine)	Massachusetts General Hospital, USA	1987
PRODIGY (PROject prescribing rationally with Decision-support In General-practice study)	Nation-wide implementation in Great Britain	1995
ERA (Early Referrals Application)	GP practices linked to university hospitals of Leicester NHS Trust, UK	2001
QMR (Quick Medical Reference)	University of Pittsburgh, University of Alabama at Birmingham	1972
POEM (PostOperative Expert Medical System)	St. James University Hospital, Leeds, UK	1992
SETH (Expert System in Clinical Toxicology)	Poison Control Centre, Rouen University Hospital, France	1992
ACORN (Admit to the Critical care unit OR Not)	Westminster Hospital, London, UK	1987
TherapyEdge HIV (Web-enabled decision support system for the treatment of HIV infection)	Subscription via Internet	2001
MDDDB (Diagnosis of dysmorphic syndromes)	Kinderzentrum, Munich, Germany	1995
NeoGanesh (Management of Mechanical Ventilation in Intensive Care)	Hospital Henri Mondor, Créteil, France	1997
VIE-PNN (Vienna Expert System for Parenteral Nutrition of Neonates)	Neonatal Intensive Care Unit, Department of Paediatrics, the University of Vienna, Austria	1996
PUFF (Pulmonary function test interpretation)	Pacific Presbyterian Medical Center, San Francisco, California	1977

## 3.2 Australian experience

An inventory of electronic decision support initiatives in Australia (Sintchenko et al. 2002) identified 35 significant electronic decision support systems in routine use in Australia. A complete listing of the inventory is at Appendix A.

Almost half the projects are multi-state or national. Projects are occurring in every state and territory, the majority in the more populous states (New South Wales and Victoria) and predominantly in primary care (40%) and hospital (28%) settings (table 5).

**TABLE 5 Project settings by location (Sintchenko et al. 2002)**

Project location	Setting of projects							Total no.
	PRIMARY CARE	HOSPITAL	HOSPITAL PHARMACY	COMMUNITY CARE	COMMUNITY PHARMACY	PATHOLOGY	MULTI-SETTING	
National/multi-state	8	2			1	2	4	17
New South Wales	2	3		1				6
Victoria	3	2					1	6
Queensland		1						1
Western Australia								0
South Australia	1	1						2
Northern Territory		1						1
Tasmania					1		1	2
<b>Total (%)</b>	<b>14 (40)</b>	<b>10 (28)</b>	<b>0</b>	<b>1 (3)</b>	<b>2 (6)</b>	<b>2 (6)</b>	<b>6 (17)</b>	<b>35 (100%)</b>

The predominant health care setting for implementing electronic decision support systems appears to be primary care. This may reflect the significant improvement in general practice computerisation, a view supported by the needs analysis report released by the Australian Division of General Practice in April 2002. The report stated that computerisation has occurred in 87 per cent of Australian practices. A significant increase in electronic diagnosis and treatment support was identified in practices surveyed, with drug interaction prompts in effect in 76 per cent of practices and scripts generated electronically in 78 per cent (table 6).

**TABLE 6** Systems functions and knowledge sources

Setting	No of systems	System functions					Knowledge sources		
		INFO RETRIEVAL	ALERTS	DIAGNOSIS	THERAPY	CLINICAL AUDIT	PUBLISHED	COMMERCIAL	IN-HOUSE
Primary care	14	14	4	5	9	4	9	3	7
Hospital	10	9	6	2	7	4	6	7	7
Community care	1	1	1				1		
Hospital pharmacy	0								
Community pharmacy	2	1	2		1	1	1	2	1
Pathology	2		1	2	1				2
Multiple settings	6	1	3		1	2	4	1	3
<b>Total</b>	<b>35</b>	<b>26</b>	<b>17</b>	<b>9</b>	<b>19</b>	<b>11</b>	<b>21</b>	<b>13</b>	<b>20</b>
<b>(%)</b>	<b>(100)</b>	<b>(74)</b>	<b>(48)</b>	<b>(26)</b>	<b>(54)</b>	<b>(31)</b>	<b>(60)</b>	<b>(37)</b>	<b>(57)</b>

Most systems in use provide Type 1 (43%) or Type 2 (43%) decision support (in relation to the four-type model at section 2.3). The estimated number of users is reasonably high. Sixty per cent of respondents estimated their system has more than 100 users; 91 per cent have more than 10 users. Most electronic decision support systems provide information retrieval functions (74%), corresponding with Type 1 decision support. Only 9 per cent of systems provided support at Types 3 or 4.

The majority of systems in the inventory (54%) identify therapy planning and management as a focus of system functionality, that is, providing information on drug dosing and interactions, therapy alerts and prescribing guidelines. Fewer systems (26%) provide support for diagnosis.

The most commonly used knowledge sources were published guidelines (60%) and in-house expert opinion (57%). Commercial databases were used in 43 per cent of systems, primarily in hospital settings.

Government is the primary driver of Australian electronic decision support. Over two thirds of projects were funded predominantly by government. A small number of projects accounted for the bulk of the investment, and typically these are funded federally. Amongst the projects reported in the inventory as being ‘in progress’, 24 were government funded and 11 were industry supported.

From the literature, it is apparent that the developments internationally, as well as in Australia, are different within the various craft groups. There has been significant progress with electronic decision support systems by general practice, and to a much lesser extent, by specialists within the hospital sector.

In the broader areas of community-based health services, it is in community pharmacies that the emergence of electronic decision support is seen as part of the dispensing process of medications. New systems in community health, such as Community Health Information Management Enterprise (CHIME) are being rolled out in New South Wales. They will have a strong clinical focus and clinical content, and include some components of electronic decision support such as risk assessment and bring forward and reminder mechanisms, but are probably categorised as Type 1 systems.

### **3.3 Comparison between published international electronic decision support system studies and Australian electronic decision support system inventory projects**

A comparison between published international studies and the Australia inventory projects (Sintchenko et al. 2002) identified that the international and Australian data sets differed in a number of ways. However, it is unclear whether these differences represent significant variations in the international and Australian electronic decision support experience, or simply reflect variations in the data collection methodologies. Specifically, the international literature data set captures electronic decision support systems that have been reported in the academic literature, and the Australian data set represents interview data from individuals associated with working clinical systems. It is likely that there is a significant publication bias in the literature. Typically, an electronic decision support system appears in the literature either because of its technical novelty or an attempt to rigorously demonstrate changes in outcomes. Electronic decision support systems that are in routine use, do not represent technically novel solutions, and are not part of a large evaluation study, are unlikely to appear in the literature. Many of the systems captured in the inventory fall into this category. Consequently, while there are differences in the two data sets it is not possible to assess whether these differences are significant.

The differences between the published international studies and the Australian inventory projects reinforce the requirement for an overarching governance framework for electronic decision support development in Australia.

## 4 THE EVIDENCE FOR BENEFITS FROM USING ELECTRONIC DECISION SUPPORT SYSTEMS

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Electronic decision support systems can deliver many benefits for the health care of consumers. By assisting consumers and health care professionals in making important decisions, electronic decision support can contribute to improved safety and quality of health care, and ultimately, to improved patient outcomes. Electronic decision support can also improve the efficiency of health care delivery.

The evidence for the role of these systems in improving the safety, quality and efficiency of health care is growing. There is particularly strong evidence for the role of electronic decision support systems in improving patient safety by reducing medication errors and adverse drug events (see section 4.1).

The systems can contribute to enhanced quality of care through increased application of clinical pathways and guidelines, and greater use of up-to-date evidence to support evidence-based practice. The improvements in quality and safety of health care from using the systems are expected to result in improved patient outcomes. The evidence for improvements to quality of health care and patient outcomes is discussed in section 4.2.

There is potential for electronic decision support systems to support greater efficiency in health care delivery through faster order processing, fewer duplicated tests, safer prescribing to reduce adverse events and changed patterns of prescribing towards less costly generic brands (see section 4.3).

Overall, the available evidence of the ability of electronic decision support systems to deliver improvements in the quality, safety and efficiency of health is promising. However, there remains a need to continue to monitor and evaluate the implementation of such systems to build the evidence base and ensure that their full potential is realised. Issues regarding evaluation of electronic decision support systems are discussed in section 4.4.

This chapter provides an overview of the evidence for the benefits of electronic decision support systems for health care. More detailed information is provided in the literature review undertaken by Sintchenko and colleagues at Appendix A.

## 4.1 The evidence for improved patient safety

Medication error is one of the most common causes of unintended harm to patients. Those medication incidents that cause harm, injury or death are described as adverse drug events.

The Second National Patient Safety Report released by the Australian Council for Safety and Quality in Health Care in July 2002 focuses on improving medication safety as a high priority. The report notes that between 2 and 3 per cent of all hospital admissions are related to problems with medicines, originating within the community or the hospital. Medication errors may involve the use of inappropriate medicines, errors in prescribing, dispensing or administering medicines, incorrect doses of medicines, or not recording previously known adverse drug reactions or allergies.

Studies in the United States suggest that medication errors are a significant cause of iatrogenic injury, death and costs in hospitals (Thomas, Dayton & Peterson 1999; Institute of Medicine 2000). It is estimated that over 770,000 people in the United States are injured or die each year in hospitals as a result of adverse drug events (Kaushal & Bates 2001). The greatest proportion (56 per cent) of preventable drug events occur at the drug ordering stage, 34 per cent at administration, 6 per cent at transcribing and 4 per cent at dispensing (Bates et al. 1995). Errors at the earlier stages, such as drug ordering, are more likely to be intercepted (48 per cent) compared to those at the administration stage (0 per cent).

The Australian Council for Safety and Quality in Health Care report (2002) notes that in Australia, and around the world, a systems approach is being developed to improve use of medicines and reduce medication incidents. The use of computerised prescribing with clinical decision support systems and adverse drug event alerts is a key strategy for reducing medication incidents.

Computerised physician order entry (POE) systems automate the medication ordering process. Automation improves standardisation and reduces problems such as the legibility of orders. Many POE systems incorporate decision support such as suggested drug doses and checks for drug allergies and interactions with other drugs listed in the medical record. Many of these systems have built-in alerts to automatically signal the possibility of an adverse drug event. POE systems are particularly useful in improving accuracy of drug ordering, the stage most likely to have a significant impact upon reducing preventable adverse drug events (Massaro et al. 1989; Ash Gorman & Hersh 1998).

Two recent United States studies have provided convincing evidence that computerised prescribing systems incorporating decision support can significantly reduce medication errors and adverse drug events (Bates et al. 1998; Bates et al. 1999). The computerised POE system was developed specifically by the hospital and contained clinical decision support such as allergy alerts and suggested drug doses.



The first study demonstrated a 55 per cent reduction in potential adverse drug events following system implementation. The second study showed an 81 per cent decrease in medication errors following system implementation, and an 86 per cent reduction in potential adverse drug events at 4 years post-implementation. An analysis of the changes in medication errors showed a very large decrease in that small proportion of errors most likely to harm patients (BMMS 2002).

In the initial stages of system implementation in the second study, there was an increase in intercepted potential adverse drug events relating to orders for potassium chloride, requiring changes to the drug's order screen. This demonstrates the importance of monitoring system implementation to identify and address any negative effects.

Further evidence for the effectiveness of electronic decision support systems in preventing adverse drug events was provided by a study of a computer-assisted management program for anti-infective agents mismatches (Evans et al. 1998). Implementation of the system led to significant reductions in orders for drugs to which the patients had reported allergies, excess drug dosages, and antibiotic-susceptibility. There were also marked reductions in the mean number of days of excessive drug dosage and in adverse events caused by anti-infective agents. These changes were accompanied by significant reductions in drug and total hospital costs and in the length of hospital stays.

In a United States hospital study, drug alerts were written to target potential adverse drug events (Raschke et al. 1998). These alerts were printed and reviewed by pharmacists and concerns were referred to prescribing doctors. Of the 1,116 drug alerts studied, 53 per cent were true positives, producing a rate of 64 potential adverse drug events per 1000 patient admissions. In 44 per cent of the cases where a change in drug management was required, doctors stated that they were unaware of the potential clinical situation leading to the alert. This study provides further evidence of the effectiveness of electronic decision support systems in reducing potential adverse drug events.

Pharmacy-based electronic decision support systems incorporating adverse drug alerts have also been found to be effective in identifying potentially dangerous drug doses or combinations that were referred back to the prescribing physician. In a United States ambulatory setting study, pharmacists evaluated medication prescriptions filled by 2.3 million people 65 years and older by using automated alerts that identified potentially dangerous drug doses or combinations (Monane et al. 1998). In one year, over 43,000 alerts were issued among 23,697 people. For 56 per cent of alerts, the physician was able to be contacted and drug management discussed. In 15 per cent of instances when the physician was contacted the alerts resulted in an immediate change in drug management, and in a further 9 per cent there was agreement to review management at the next patient visit.



Alerts generated by electronic decision support systems have contributed to patient safety by increasing the proportion of corollary tests ordered in association with prescribed medications. For example, orders for laboratory tests to check for adverse reactions as a result of a medication correctly ordered, such as a check of electrolytes when ordering potassium for a patient (Overhage et al. 1997).

In addition, alerts have been shown to result in faster treatment by highlighting patients whose medication needed review. Rind et al. (1994) assessed the impact of an alert system that notified doctors about patients experiencing rising creatinine types and receiving nephrotoxic or renally excreted medications and who therefore required an adjustment to their medications in order to prevent renal damage. They found that use of the alerts was associated with a significantly faster average response to change patients' medications. While the absolute risk of renal impairment in these patients was low, the alert system reduced this risk by 55 per cent.

Overall, there is a body of studies that provides good evidence of the effectiveness of electronic decision support systems, particularly in association with POE systems, to increase patient safety by reducing medication errors and potential adverse drug events (Classen et al. 1997; Armstrong & Denmark 1998; Nolan et al. 1999; Australian Council for Safety and Quality in Health Care July 2002).

Birkmeyer et al. (2000) used data from studies of computerised prescribing systems incorporating decision support undertaken by Bates and colleagues (Bates et al. 1998; Bates et al. 1999). The authors estimated the number of potential adverse drug events that would be prevented if these systems were implemented nationwide in the United States. They calculated that implementation would prevent approximately 522,000 adverse drug events each year. Extrapolating further, they concluded that: '... if only 0.1 per cent of such errors were fatal, over 500 deaths would be avoided by POE every year' (Birkmeyer et al. 2000).

## **4.2 The evidence for improved quality of care and patient outcomes**

Electronic decision support can contribute to improved quality of care by improving compliance with clinical guidelines; increasing the use of evidence to support clinical decisions; improving drug prescribing and dosing decisions; encouraging preventive care; and improving diagnostic accuracy. Electronic decision support also has the potential to improve clinical practice through data feedback on practice patterns. It is expected that improvements to quality of care achieved through electronic decision support systems would lead to improved patient satisfaction and improved patient outcomes.

## Improved compliance with clinical guidelines

Electronic decision support systems can improve the quality of medical care by helping clinicians comply with clinical guidelines and care standards (Dennis et al. 1993; Overhage, Tierney & McDonald 1996; Tierney & McDonald 1996; Lobach & Hammond 1997; Harpole et al. 1997; Evans et al. 1998; Birkmeyer et al. 2000).

In eight studies of systems designed to provide therapeutic and management advice, usually based on a set of published guidelines, increased compliance with the guidelines by physicians led to better practice, as well as more uniform standards of care amongst the participating physicians (Smith et al. 1999; Thomas, Dayton & Peterson 1999; Dayton et al. 2000; Emery et al. 2000; Kellet 2001; Knab et al. 2001; Medow et al. 2001; Lesourd et al. 2002).

In a randomised controlled trial, Dayton et al. (2000) found that an electronic decision support system improved adherence to tuberculosis treatment guidelines, leading to the intervention group correctly using therapy in 96 per cent of cases, compared to 57 per cent for control cases. Emery et al. (2000) reported similar outcomes when an electronic decision support system was used in primary care to assist in the management of familial breast and ovarian cancer.

In a randomised control trial, Shojania et al. (1998) found that use of a computerised guideline for intravenous vancomycin as part of a POE system led to a 30 per cent reduction in the use of vancomycin, with a 36 per cent reduction in duration of therapy compared to clinicians not exposed to the guidelines.

In an analysis of tuberculosis patients, Knirsch et al. (1998) found that their electronic decision support system had the potential to achieve a significant improvement in patient isolation rates (75 per cent of 171 patients instead of 51 per cent,  $p < .001$ ).

Not all studies found that the electronic decision support system had an impact on patterns of care. Rocha et al. (2001) implemented such a system to detect and manage infections in a paediatric hospital. They found no statistical difference between clinicians' treatment strategies before and after implementation. Hetlevik et al. (1999; 2000) implemented a system of clinical guidelines for diabetes mellitus in general practice, with a specific electronic decision support system as part of the intervention. They found no clinically significant change in doctors' behaviour or in patient outcomes between control and intervention groups.

A study of an electronic decision support system designed to increase the appropriate use of fibrinolysis in 894 patients with myocardial infarction found no significant increase in the percentage of patients appropriately receiving fibrinolysis after the system was introduced (Kellet 2001). However, time between consultation and injection was significantly decreased after implementation, and this improvement was attributed to the system.

## Increased use of evidence in clinical decision-making

Electronic decision support can improve access to research evidence and increase the use of evidence in clinical decision-making (Friedman et al. 1999; Kushniruk et al. 2001; Westbrook & Gosling 2001). Provision of access to online evidence via a point-of-care system may occur in one of two ways. It can be an 'active request' for information by the clinician (eg a request to view an online clinical guideline) or alternatively, evidence may be delivered to the clinician in response to an event, such as making an order selection.

The Clinical Information Access Program (CIAP) implemented in NSW is a 24-hour online, point-of-care evidence retrieval system. Evaluation of the use and impact of the CIAP has demonstrated significant use of evidence by clinical staff to support direct patient care, and examples of specific individual improvements in patient outcomes as a result of applying the evidence retrieved (Westbrook & Gosling 2001).

In a survey of 5,500 clinicians in NSW who used the CIAP, 88 per cent reported that they thought CIAP had the potential to improve patient care and 41 per cent reported direct experience of this. Patterns of use of this system by 55,000 clinicians across the state demonstrated that evidence retrieval is principally related to direct patient care, but good use is also made of the system to support continuing education activities and research (Westbrook & Gosling 2001).

A randomised controlled trial assessed the impact of decision support information (evidence regarding the effectiveness of a 5-day course of antibiotics versus a 10-day course) on paediatricians' choice of length of antibiotic course (Christakis et al. 2001). Those clinicians randomised to receive the decision support responded positively: the proportion of antibiotic prescriptions for less than 10 days duration increased from 51 per cent pre-intervention to 70 per cent post-intervention. The paediatricians in the control group also increased their use of the recommended dose, but by a smaller proportion. This change was attributed to a diffusion of the evidence from the members of the control group who were working in the same clinic.

## Improved drug prescribing decisions

Electronic decision support systems have the potential to increase appropriate and safe prescribing decisions by providing information about suggested drug doses and frequency of doses as well as prompts to order particular drugs under specific conditions.

In a systematic review, Hunt et al. (1996) identified 15 studies that involved the use of electronic decision support systems to assist dosing of potentially toxic drugs. Of eight studies relating to dosing of intravenous drugs, six found improvements following the use of the decision support system. Seven studies examined the use of decision support systems for warfarin dosing but found inconsistent results:

some studies reported benefits and others showed no effect. It was concluded that decision support systems result in more effective titration of intravenously administered medications where the pharmacokinetics are well understood.

Teich et al. (2000) investigated the impact of decision support embedded in a computerised POE system over a three-year period. Four specific decision support interventions were examined: a prompt to use a cheaper generic drug when a more expensive drug was initially ordered; suggested drug doses for each medication ordered; a recommended frequency of dose for specific intravenous drugs; and a prompt to suggest the order of an anticoagulant for patients prescribed bed rest.

For all drug ordering interventions there was an immediate positive impact, with greater compliance with the recommended drug orders. Compliance with the generic drug choice changed from around 14 per cent pre implementation, to over 80 per cent at 2 months post system implementation, to 97 per cent compliance at 1 and 2 year follow up. The proportion of drug orders that exceeded the recommended maximum dose dropped from 2 per cent in the pre-implementation period to less than 0.3 per cent at 2 years post-implementation. Changes occurred in the frequency of dose to reflect the recommended frequency. Six per cent compliance pre-implementation increased to 94 per cent compliance at 1, 2 and 3-year follow up. Orders for anticoagulants for patients who were prescribed bed rest increased from 24 per cent pre-implementation to 54 per cent at 2-year follow up. This study thus provides some evidence of the capacity of electronic decision support systems to influence aspects of the medication ordering behaviour of clinicians.

## Encouraging preventive care

Electronic decision support systems aimed at providing preventive care reminders have been shown to be effective in primary care settings. A systematic review of decision support systems (Hunt et al. 1998) reported that of 19 systems (18 in primary care) aimed at providing preventive care reminders, 14 (74 per cent) reported benefits to the processes of care. The review therefore concluded that preventive care reminder systems are a reasonably effective intervention in an ambulatory setting.

However, other studies have found that alerts have little effect in changing clinician behaviour. One example is a study of the impact of reminders printed on daily hospital ward round reports to prompt hospital physicians about preventive care for patients. The study found that the alerts had little effect on physicians' implementation of preventative care. This was despite the clinicians reporting that they believed acute hospitalisation provided an appropriate opportunity for reviewing and implementing preventive care (Overhage, Tierney & McDonald 1996).

## Improved diagnostic accuracy

Several electronic decision support systems used to assist in diagnosis led to a significant improvement in diagnostic accuracy and subsequent improvement in decision confidence.

Aase (1999) found that using an electronic decision support system to diagnose acute chest pain reduced the number of unnecessary referrals to the coronary care unit from 35 per cent to 19 per cent. The number of patients in need of coronary care unit observation who were misallocated to a general ward was reduced from 13 per cent to 10 per cent.

Friedman et al. (1999) found that clinicians' diagnostic performance improved from 39.5 per cent to 45.4 per cent when an electronic decision support system was used to assist in the diagnosis of 36 difficult cases with known diagnoses. However, in 6 per cent of cases, the clinician actually changed from the correct diagnosis to an incorrect diagnosis after referring to the system.

## Data feedback to change clinical practice patterns

Electronic decision support has potential to contribute to practice audit and clinical outcome analysis. Electronic decision support systems provide the opportunity to make use of collected data to review clinical practice patterns such as medications and tests ordered for specific patient groups. This evidence base can be used to review current practice and discuss variations in practice. Feedback to clinicians of data regarding clinical practice has been demonstrated to have a positive impact on care patterns (Westbrook & Goodwin 1990; Westbrook 1991) and cost of care (Buck & White 1974; Beilby & Silagy 1997).

There have been attempts to develop specific decision support systems for reviewing clinical practice patterns against guidelines, but no reports of the outcomes (Balas et al. 1994). The feedback of clinical practice and evaluation data to groups within the organisation is an important element in transforming an organisation. The extent to which feedback loops generate effective change is itself a measure of the performance of the organisation (Eoyang & Berkas 1999). The potential strength of electronic decision support systems in generating new data feedback loops is rarely discussed in the literature and it appears that potential is yet to be fully exploited.

## Improvements in patient satisfaction

While improvement in patient satisfaction as a result of adopting electronic decision support systems has been advanced as a potential benefit, there is little substantiating evidence. Studies of patients' views of electronic decision support systems have

focused on systems used in general practice. For example, Legler and Oates (1993) found patients' ratings of general practitioners' use of computers to enter patient data during a consultation compared to paper and pen entry were not significantly different. However Greatbatch, Murphy and Dingwall (2001) found that such systems resulted in subtle changes to the structure and process of discussions between patients and their general practitioners.

Ruland (2002) reported on the implementation of a handheld electronic decision support system for planning preference-based care. The system assisted nurses in eliciting patients' preferences for functional performance at the bedside. Once the system was implemented, nurses' decisions were more consistent with patient preferences, and improved compliance with patient preferences was achieved.

Dexter et al. (1998) found that the use of computer-generated reminders resulted in an increase in the frequency of advance directive discussions between patients and their primary caregivers and the frequency with which advance directives were consequently established.

While patient satisfaction is an important indicator, it is multi-dimensional and fraught with measurement difficulties (Westbrook 1993). Improvements in the quality, safety and efficiency of health care resulting from the implementation of electronic decision support systems is likely to influence patients' satisfaction with care. However, until comprehensive electronic decision support systems are in place, significant improvements in patient satisfaction are unlikely to occur. Research into appropriate measurement tools is required and a long-term perspective needed.

## Improved patient outcomes

It is expected that improvements to quality and safety of health care through electronic decision support would lead to better patient outcomes. However, direct improvement to clinical or health outcomes is rarely measured, largely due to the difficulty of undertaking such studies.

A study that included a direct measure of improved health was undertaken in a general medical clinic where clinicians were randomised to a reminder system over a two-year period (McDonald et al. 1984). Patients eligible for a flu or pneumococcal vaccine and who attended a clinician who received the reminder system experienced significantly fewer winter hospitalisations and emergency room visits than patients in the control group. However no significant improvement in outcomes was found for patients who received other forms of preventive care during the trial.

Improved patient outcomes were found by East et al. (1999) when an electronic decision support system was used to assist in ventilator management for respiratory diseases.



This study found a significant reduction in morbidity, incidence and severity of over-distension lung injury in the protocol group ( $p < .001$ ) when the system was implemented.

However, in some studies, changes in patterns of care introduced by use of electronic decision support systems have not led to measurable improvements in patient outcomes. Shiffman et al. (2000) found that the introduction of an electronic decision support system with the clinical guidelines for management of asthma changed patterns of care, resulting in increased measurements of peak expiratory flow rate, increased administration of nebulised beta2-agonists and longer consultations. This led to an increase in costs per visit, but had no measurable effect on immediate disposition or subsequent emergency department visits, hospitalisations, missed school, or carers' missed work, during the seven days post visit.

In two randomised control trials in which electronic clinical guidelines were assessed as an intervention in management of hypertensive patients, neither found any significant difference between the blood pressures of the control and intervention groups (Hetlevik et al. 1999; Montgomery et al. 2000). Although both studies used morbidity as a primary outcome, neither found a significant impact due to the electronic decision support system.

## 4.3 The evidence for improved efficiency of health care delivery

Studies relating to the impact of electronic decision support systems on the efficiency of health care delivery have focused on:

- Reductions in physician time spent on administrative tasks, thus releasing time to be spent on patient care.
- Reductions in costs due to fewer medication errors and adverse drug events; increased efficiency in the execution of patient care, particularly in relation to tests and drug orders; and increased use of generic drug brands.

Less attention has been paid to measuring improved efficiency due to review of clinical practice, the greater use of evidence and clinical pathways, or greater organisational responsiveness to change (Mason et al. 2001).

### Reduction in physician time spent on administrative tasks

One potential benefit of the implementation of electronic decision support systems is that the increased efficiency of administrative tasks allows clinicians to spend more time in direct patient care (Brown et al. 1995; Shu et al. 2001).

Shu et al. (2001) undertook a study of the impact of a POE system on time spent ordering and time available for other tasks at Massachusetts General Hospital in the United States. They applied a modified version of work sampling using a random reminder method. After implementation of the system, interns spent 3 per cent more of their time with patients (from 13 per cent to 16 per cent), 6 per cent more of their time alone (32 per cent to 38 per cent), and less time with other physicians (47 per cent to 41 per cent).

Tierney et al. (1993) conducted a time and motion study to determine time spent by clinicians in the order entry process. Use of the POE system resulted in increased time writing orders compared to paper orders (59 minutes versus 26 minutes). However, clinicians using the POE system spent less time recording routine patient record data (6 minutes less per day). Also, medication orders were filled more quickly when the POE system was used (63 minutes faster on average for admitting medication orders and 34 minutes faster for daily drug orders).

Some studies have indicated that POE systems increase the amount of time clinicians spend on the ordering process (Overhage et al. 2001; Shu et al. 2001). In one study, clinicians were found to spend a greater proportion of their time writing orders after implementation of a POE system, from 2 per cent pre-implementation to 9 per cent post-implementation. However there was a 2 per cent saving in time related to other activities associated with the ordering process. Thus in total there was a net increase of only 5 per cent in the proportion of time physicians spent on the ordering process (Shu et al. 2001).

In another study, the time clinicians spent writing orders increased after a POE system was implemented, from about 2 per cent pre-implementation to 10–12 per cent post-implementation (Roesner 2000). This translated into an average of 40 minutes longer per day writing orders. As physicians became more used to the system, the time spent writing orders reduced to an average of 20 minutes per day. Changes to the system to allow group orders for similar patients made a considerable impact on reducing time further.

POE systems also change the work practices of other health professionals. Murray et al. (1998) undertook work-sampling studies to assess the impact of a POE system on pharmacists' work patterns. They found that pharmacists spent significantly more time checking prescriptions and problem solving and significantly less time filling prescriptions after the POE system was implemented.

Another study of the time taken for clinicians in an acute care setting to view test results available online found that 45 per cent of urgent accident and emergency department biochemistry test results and 29 per cent of ward requests were never accessed via ward terminals (Kilpatrick & Holding 2001). (Kilpatrick & Holding 2001). Around one quarter of results were accessed within an hour of becoming available.



A further 16 per cent were accessed between 1 and 3 hours. In 3 per cent of the accident and emergency department results that were never accessed, retrospective review showed that the findings might have led to an immediate change in clinical management. Improved efficiency in reporting results was not sufficient to improve clinical management, which supports the need to understand clinical processes rather than focussing on isolated clinical tasks.

These results highlight the limited use of single indicators of improved efficiency in understanding the overall impact of an electronic decision support system on an organisation. Thus the extent to which such systems release clinicians from administrative tasks thus allowing them to spend a greater proportion of their time in patient care will vary, depending upon multiple factors such as type of system used, professional group, tasks to be undertaken, and experience with the system.

Measures of improved efficiency as a result of implementing electronic decision support systems have tended to adopt a narrow focus, such as time taken in the ordering process alone. A more holistic approach that considers efficiency across the entire clinical process, for example, ordering tests and retrieving and interpreting results, is likely to provide a more accurate view of efficiency. The groups to whom efficiency gains accrue are also important and studies have rarely attempted to deal with this level of measurement complexity.

## Reductions in costs

There is some evidence of reductions in costs associated with electronic decision support implemented as part of computerised POE systems in hospitals. The savings were largely due to the increased use of less expensive tests and drugs, and fewer medication errors and adverse drug events.

In the United States, one adverse drug event is estimated to add an average of \$2000–\$6000 to the cost of a patient admission. On this basis, adverse drug events are estimated to cost a total of over \$2 billion each year in United States hospitals alone (Raschke et al. 1998). Therefore, electronic decision support systems demonstrated to reduce adverse events should also result in significantly lower costs.

Several estimates of the money saved as a result of POE systems have been made. At Brigham and Women's hospital in the United States, POE systems are estimated to save about \$5–10 million per year, largely due to the increased use of less expensive tests and drugs. In a randomised controlled trial, Tierney et al. (1993) demonstrated that patients treated by physicians who used a POE system that included costs of specific drugs and diagnostic tests had less expensive hospital stays than did patients treated by clinicians without access to the POE system. When the cost savings due to reduced costs per admission were extrapolated for the teaching hospital, savings in the order

of \$3 million were identified. However, no adjustments were made to account for fixed or marginal costs.

In some studies, cost savings using an electronic decision support system were calculated on the basis of a reduction in physician ordering. For example, Persson et al. (2000) found a total cost reduction of 33 to 40 per cent based on the use of a decision support system that suggested significantly more thiazides and significantly fewer calcium antagonists than the physicians had prescribed. However, these types of analyses typically do not take into account costs such as that of implementing and maintaining the electronic decision support system, nor of training staff in its use.

Electronic decision support systems have not always been found to reduce costs. For example, Shiffman et al. (2000) found that as a result of their intervention, visits lasted longer and fees were higher (\$145.61 versus \$103.11). Although clinician adherence to guidelines was increased, no improvement could be demonstrated in observed intermediate-term patient outcomes.

## 4.4 Evaluation of electronic decision support systems

Overall, the available evidence is promising regarding the impact of electronic decision support systems to deliver improvements in the quality, safety and efficiency of health. Reductions in medication errors and adverse drug events appear impressive, though evidence has been derived from a relatively small number of United States studies.

In assessing the research evidence, it is important to understand the context in which study results were produced. To date, the majority of studies have been undertaken in the United States and importantly, most have involved electronic decision support systems that have been developed internally and customised for individual health care organisations. The question as to whether the impressive results from custom-built systems such as those reported by Bates et al. (1999) can be reproduced with 'plug and play' commercial systems, is yet to be answered (Poikonen & Leventhal 1999).

... few if any commercial POE products undergo any pre-market testing similar to the evaluation of a new medication or medical device (Gawande & Bates 2000).

The effectiveness of electronic decision support systems depends on the quality of the embedded knowledge databases and alert systems. For example, the study by Teich et al. (2000) achieved substantial reductions in adverse drug events and changes in prescribing behaviour. It involved a POE system that was developed internally and

relied on a strong expert group to formulate the drug recommendations that provided the basis for the drug intervention alerts. Producing care alerts is an arduous and complex process.

It has been argued that:

An organisation proceeding without an understanding of the need to implement and support custom medication rules and alerts and without providing them would be shortsighted (Poikonen & Leventhal 1999, p. 4)

The judicious use of alerts is also important. Studies examining the frequency of alerts in relation to action taken revealed a negative correlation — the more alerts generated the smaller the percentage of instances in which action is taken.

Most studies have focused on the evaluation of POE systems; thus the evidence regarding the impact of other electronic decision support systems is limited.

Improvements in compliance with clinical guidelines are evident, however there is also considerable evidence that compliance is variable and related to many factors. In assessing studies of the effectiveness of electronic decision support systems in improving patient care processes and outcomes, it is necessary not only to measure specific indicators, such as proportion of medication errors, but also to understand the underlying causes of those errors. Electronic decision support systems in general focus on specific clinical tasks. However, to understand how electronic decision support systems can lead to improvements in health care, clinical tasks must be viewed within the context and totality of clinical work processes.

## 5 THE NEEDS OF CLINICIANS AND THE HEALTH INFORMATION INDUSTRY — OUTCOMES FROM CONSULTATIONS

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The Taskforce commissioned a report on the needs of clinicians and the health information industry in relation to electronic decision support. The approaches used to produce the report included:

- A review of existing literature, studies and survey documents to determine the needs of the health information industry and clinicians in relation to decision support information.
- Individual consultations and focus group meetings with the aim of exploring in greater depth issues of particular importance to these stakeholder groups.
- An analysis and synthesis of the collected information describing the key issues.

Interviews were held with about fifty participants and forums were held in four capital cities. Sixty-eight participants attended these forums. The following provides an overview of the outcomes from these consultations. A full report is at Appendix B.

### 5.1 The needs of clinicians

#### The degree of participant exposure to electronic decision support systems

The participants felt it was not clear what constituted an electronic decision support system as they typically form part of a more comprehensive patient management system. Many of the participants had either used medication prescribing or pharmacy dispensing systems or had seen them demonstrated. Participants were also familiar with reminder facilities within systems. Many interviewees had used online medical guideline resources and used them regularly in their work environment, including:

- pharmaceutical databases such as MIMS, A–Z DEX, PPGuide
- biomedical database such as Cochrane, Ovid and Micromedex
- text books online such as Harrison’s and Martindale’s
- decision support databases through Therapeutic Guidelines Ltd.

## The electronic decision support information needs of clinicians

Participants identified the following as their main information needs regarding electronic decision support:

- quality and safety of electronic decision support systems
- common terminology
- software functionality
- flexible training
- the process of approving therapeutic guidelines
- standard minimum data sets
- standard messaging
- the role of advertising
- privacy.

These are discussed in more detail below.

### Quality and safety of electronic decision support systems

The reliability and accuracy of electronic decision support systems and the quality of the underlying knowledge base emerged as common themes in the consultations. In particular, the ability to trust a system that may be fallible was raised. Such a scenario would further strengthen the case for authenticating clinical guidelines and the need for a rigorous test environment and accreditation system.

### Common terminology

Clinicians expressed their concern at the current situation regarding terminology and the variety of interpretations in existence across the health sector. It was suggested that the consolidation of terminology would be a direct benefit to, and a requirement for, any national approach to electronic decision support systems. This was considered one of the high priorities for work in the short term. The United Kingdom has identified a similar need and is currently developing the CPRS project<sup>9</sup> in an attempt to define common terminology for medicines and medical devices.

### Software functionality

Participants regarded the portability and reliability of software as an important part of the functionality of electronic decision support systems and believed that the use

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<sup>9</sup> [www.nhs.uk/nhsia/ukcprs](http://www.nhs.uk/nhsia/ukcprs)

of handheld devices should be a key component of any future systems. The ability to exploit web-based technology is also important, particularly in providing facilities in the rural sector.

Health professionals need to have electronic decision support systems available at the point of care. If the systems were not available at the point of care, some participants felt that some professions would be little motivated to use them. For example, the systems need to be available as part of bedside monitoring in areas such as intensive care.

Health professionals also believed that unless the use of electronic decision support systems saved time and money, it would be difficult to sustain the impetus for their use.

### **Flexible training**

Participants considered that appropriate training in the use of electronic decision support systems was crucial, although it would need to be flexible to cater for the different needs of clinician groups. Time spent away from the consultation process needs to be minimised and innovative ways of training explored. It was suggested that training would be less complicated if it were structured around work practice and such an approach would encourage increased participation and uptake. The Australian Divisions of General Practice adopted a similar approach in the deployment of general practice desktops.

### **The approval process for medical and therapeutic guidelines**

While there is a national approach to the production of guidelines through the National Health and Medical Research Council, many of the participants thought that the process of approving guidelines could be further improved. Participants acknowledged that there had been changes to the National Health and Medical Research Council processes over recent years in order to streamline them. However the currency of published guidelines was seen to be a particular problem, resulting in their limited usefulness on occasions. The maintenance of guidelines within electronic decision support systems would require mechanisms for their rapid approval, dissemination and incorporation within such systems.

### **Standard minimum data sets**

Clinicians expressed the need for a common clinical data set, endorsed nationally and incorporated within all appropriate health application software. The lack of guidance in this area was seen as frustrating. Currently within Australia there is a

variety of data sets in use throughout the health sector. The consolidation of these data sets into a national data set would improve reporting at all levels of the health system (national, state/territory and local).

### **Standard messaging**

Health Level 7 (HL7) is the current Australian standard for health messaging. Participants believed that the application of HL7 across the industry would dramatically improve both the ability of disparate systems to communicate and the availability of data for electronic decision support systems. Participants endorsed a consistent and coordinated approach to the use of the HL7 standard.

### **Advertising in clinical software**

Participants expressed concern over the use of medication advertising in some prescribing software. This was seen as inappropriate, particularly at the time of prescribing. There was concern over the influence that such advertising could have on the decision making process. The use of standards or regulation in the use of advertising within clinical software requires consideration as part of any electronic decision support system implementation.

### **Infrastructure**

Participants believed there is a need for appropriate levels of technical infrastructure, including high levels of access, system availability and performance. They believed health care organisations would find it difficult to implement and sustain electronic decision support systems within current financial constraints. Appropriate resourcing of infrastructure will therefore be important.

### **Privacy of sensitive data**

The need for a national approach to privacy, confidentiality and security has already been identified. Health Ministers are committed to ensuring that the privacy of personal health information is upheld in the electronic environment.

Where the use of an electronic decision support system is locally provided and client information is retained locally by the clinician involved in the provision of care, no new privacy issues arise (apart from normal security and confidentiality constraints). However, where a national approach to electronic decision support systems is adopted, or where such systems make use of information provided by external agencies, additional privacy and confidentiality issues will arise.

## Governance of electronic decision support systems

Participants believed that existing governance structures are currently operating in isolation from one another, and should be consolidated in a national approach to electronic decision support systems.

Participants were reluctant to see the establishment of yet another organisation to manage the development of the systems. However, it was acknowledged that no organisation currently provided all aspects of the required role, and a broader remit and a re-negotiation of roles would be required.

Whichever organisation was ultimately given the task of managing the national development of the systems, participants believed that appropriate professional representation would be required.

Overall, there was general support for a national approach to the development of electronic decision support systems.

## Uptake of electronic decision support systems

Participants identified the following issues as likely to affect the uptake and use of electronic decision support systems:

- the consolidation of clinical guidelines for the priority health issues and the incorporation of this guidance within the systems at an early stage
- a reduction in adverse events and incorporation of the systems within electronic clinical order functionality and clinical pathways
- improvements in workflow in order to free-up clinician time for what is seen as a time-consuming process at the point of care
- the use of standard terminology
- incentive payments to encourage the use of the systems, for example in health prevention and chronic disease management
- high levels of system availability and access
- availability of initial and ongoing training.

## Long-term investment in technology

Many participants believed a greater financial commitment would be required from both Commonwealth and state governments if electronic decision support systems are to be successful.



While participants did not see it as the Commonwealth government's responsibility to shoulder all of the costs, initial funding would be required, as well as a commitment to maintaining funding levels as part of the Commonwealth/State Healthcare Agreements. Only this level of financial commitment would ensure the long-term viability of electronic decision support systems.

Participants believed current spending on information management and technology to be approximately 1 per cent of health spending at state level. It was thought that electronic decision support systems would be unsustainable at this low level of funding, and funding for information management and technology should approach the recommended minimum of 3 per cent of health spending.

## Role of the government

Participants believed that government has a number of roles. These roles included:

- funding responsibilities—without significant funding, the provision of electronic decision support systems that meet safety and quality standards will not be feasible. Funding should be based on incentives to encourage the required changes and uptake and use of the systems
- the standards required for the development of electronic decision support systems in the e-health framework that is being provided through the Health Online initiatives
- ensuring that there are mechanisms to guarantee the participation of clinicians and consumers in determining electronic decision support systems standards
- establishing accreditation processes and complying with legislative requirements such as privacy
- providing ongoing mechanisms to ensure quality
- enabling the creation of guidelines for electronic decision support systems associated with clinical therapies (most information is held by commercial organisations)
- ensuring there is independent evaluation of the provision of electronic decision support systems.

## Non-government roles

Non-government roles were identified as including:

- developing and providing electronic decision support systems products
- providing an independent complaints mechanism
- ownership of intellectual property regarding electronic decision support systems.

## Priorities for moving forward

Clinicians identified the following priorities in advancing the development of electronic decision support systems:

- the provision of reliable and accurate electronic decision support systems incorporating up-to-date clinical information that has been rigorously tested and accredited
- greater software functionality, including the availability of electronic decision support systems at the point-of-care
- the development of common terminology, clinical data sets and messaging standards
- more training opportunities and more appropriate training in the use of electronic decision support systems
- greater investment in health information technology.

## 5.2 The needs of the health information industry

### Organisational details and familiarity with electronic decision support systems

Industry representation covered a variety of leading health solution providers, ranging from small, local operators to large international corporations. Industry participants argued that spending had declined in the states and territories and that Commonwealth projects had not been sufficiently coordinated.

### Electronic decision support market capacity

All participants professed to have various types of electronic decision support systems available. Types 1–3 were the most common. Some participants professed to have Type 4 systems available to deploy, but cited the down-turn in spending as the reason for their lack of uptake and use within Australia.

Many vendor products are based in the United States or the United Kingdom. The industry recognised that this can often be a barrier to uptake of systems in Australia. However, participants cited the relative size of the Australian market in comparison with the United States and the United Kingdom as key reasons why it would always be difficult to sustain totally Australian versions of products built from the ground up for Australian conditions.

Industry participants welcomed ongoing dialogue and a coordinated approach to defining system requirement and adopting standards. Participants were confident that regular, open communication and a commitment to dialogue would produce real long-term gains for the Australian health software industry, and boost industry confidence in the immediate future. However, participants were unsure of the implications of accreditation.

Participants acknowledged that some standards and some accreditation already exist within the industry and further standards development and accreditation would not be resisted. However, it would be necessary to communicate government requirements clearly and to establish mechanisms that did not make compliance a cumbersome and costly process.

Industry participants believed that greater progress could be made by the rigorous application of current standards, the use of accredited guidelines and knowledge bases only, and adherence to standards for messaging, privacy and security.

## **Governance of electronic decision support systems**

Industry participants called for a national decision-making body to consolidate national efforts to win future investment in health information systems, innovation and sustainability. Participants believed that at present, there is insufficient direction from the government on plans for further investment to support electronic decision support systems, and that this is a major reason for industry suspending further investment in the current financial climate.

Industry participants held no firm views on the most appropriate organisation to take on the role of a national decision-making body, but said the organisation required a high level of policy making and funding, and as such, would probably sit within the structure of the Commonwealth.

Industry believed there was a need to coordinate and consolidate current initiatives and investment in electronic decision support systems. Small investments were not sustainable in the long term and industry believed it was more advantageous to identify a few key areas over the next 2–3 years and focus on making these a success with a small number of industry partners.

Both industry and the Commonwealth would benefit in terms of economies of scale from coordinated national implementation of electronic decision support systems. Strong national direction was attractive to industry participants in providing clear directions and encouraging industry to invest in the future direction of these systems in Australia.

Industry participants saw the implementation of one national system as unrealistic, but not impossible. The preferred approach would be strong Commonwealth direction, accompanied by state/territory implementation through a panel of industry vendors.

Industry participants are keen to be involved in the development of electronic decision support systems in partnership with the Commonwealth to ensure the long-term sustainability of such an endeavour. How this might occur would need to be explored in more detail, but engaging industry will be essential to encourage innovation and investment in this area. Industry participants welcomed the opportunity to be involved in advancing electronic decision support systems but were clear that this could not occur in the current structure.

## Priorities for moving forward

The following priorities were identified by industry participants in advancing the development of electronic decision support systems:

- greater investment in health information technology
- automation of the end-to-end processes, as opposed to the separate components making up the process. This approach will provide better quality and greater savings
- rationalisation of spending on information management and technology in health care and cost benefit analyses of some of the existing legacy systems
- the provision of a clear road map for the development of electronic decision support systems involving industry, public sector, clinicians and academia
- the establishment of an electronic decision support industry reference group
- early agreement on the required standards.

## 6 BARRIERS TO SUCCESSFUL IMPLEMENTATION OF ELECTRONIC DECISION SUPPORT SYSTEMS

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It has proven difficult to design and implement electronic decision support systems successfully. A range of issues and challenges need to be addressed before health care professionals will use the systems more extensively. Some of these issues have been raised in chapter 5. In summary, the issues to be overcome include:

- concerns about quality and safety aspects of the systems
- gaining the acceptance of health professionals
- implementation issues
- level of investment required.

These issues are discussed in more detail below.

### 6.1 Quality and safety issues

The three main issues associated with quality and safety aspects of electronic decision support systems are content, system and testing.

#### Content

The content issues relating to quality and safety are about the quality of the underlying knowledge base used in electronic decision support systems. Some of the content issues are: whether knowledge bases have been translated accurately into electronic form, whether they are based on evidence, whether they have been peer reviewed, whether there been trials to test the ‘rules’, the date evidence was made available, the ability to use the latest available evidence, and how frequently evidence is updated. These issues need to be addressed if health professionals are to increase their uptake of electronic decision support systems.

The issues are exacerbated by the fact that many electronic decision support systems are limited in scope because each was created for a specific need/task. As a result, health care professionals are required to learn about different systems for each type of decision task. Furthermore, the content of the systems is not generally transferable between health sectors. For example, the degree of specialisation within the

hospital sector requires facilities to maintain decision support rules locally. In contrast, decision support rules for general practice need to take into account the ‘frequent flyer’ issues regularly confronted by general practice (Remmlinger 2002) as well as the priority areas of prevention, chronic disease management and prescribing ([www.nice.org.uk](http://www.nice.org.uk)).

## Systems

All systems and processes have a degree of failure. The most likely areas of failure of electronic decision support systems are not yet well known, which makes it difficult to develop appropriate risk management strategies. The interface between clinicians and the developers of systems is a key concern and needs to be considered in the development of the systems. The reliability and robustness of systems is paramount. For example, pathology services potentially handle thousands of orders a day and consequently need electronic decision support systems that can cope reliably with large volumes of information.

Lack of system standardisation and compatibility effects quality and safety. In the health sector, for example, medical devices must conform to performance standards; the process of constructing electronic decision support systems must also adhere to process quality standards (Miller & Gardner 1997). The process engineering and testing of a system should, by analogy, ensure that the software developed has been engineered to accepted information technology standards. As electronic decision support systems are intended to be used in clinical settings, and by design, are intended to influence clinical decisions, it is important that such systems do not have an adverse influence on clinical decisions. Adverse performance can be due to errors in system development, either in the design of the system, or its implementation.

Furthermore, as the health care industry remains fragmented, with poor information technology infrastructure, many health care settings have not yet fully deployed standard tools such as local area networks, electronic mail, Internet and other enabling technologies.

## Testing

Few electronic decision support systems in operation in Australia use standard quality processes or quality testing to ensure that the system performed correctly. Consequently, there is a general lack of testing of the content, internal processing, content delivery and production processes of the systems. End-to-end testing and evaluation is required to ensure the quality and safety of systems.

One way of achieving certainty in this area is through an accreditation process, that is, a process of determining that systems meet the set standards. The experience of the United Kingdom suggests the need to accredit the systems.

## 6.2 User acceptance issues

User acceptance is a significant issue in the development and greater use of electronic decision support systems. The following factors are identified as influencing user acceptance of the systems.

### Effort and process

It must be possible to operate the system in the normal process of care with minimal impact on the three-way relationship between clinician, consumer and computer. The process of using a system must at least save the clinician time, and preferably money, for its use to be sustained. Clinicians expect a productivity improvement from using technology, and an electronic decision support system is no exception.

### Confidence in the knowledge base

Confidence in the underlying knowledge base is a critical aspect of the motivation to use an electronic decision support system. Clinicians will not use a system they regard as unduly directing them other than on the basis of independent peer reviewed research. They regard access to that research as a necessary feature of the system. They expect that the knowledge within such systems must match that of the most trusted experts within each area of clinical practice. They require accurate translation of the knowledge base into an electronic format. Clinicians argue that many systems are limited because of the quality of the data entered and the failure to reflect local patient mix and practice patterns.

Clinicians' confidence in electronic decision support systems is an issue that needs particular attention, as evidence has shown that few systems undergo any formal evaluation, usually due to a claimed lack of project resources. In many cases, evaluation consists only of a case study, or some form of qualitative analysis using focus groups, descriptive studies and user surveys. Few carry out any rigorous form of evaluation either through a before–after study or a randomised controlled trial (RCT) and only a small number of systems are tested in randomised control studies.

The absence of significant evaluation of the impact of a system on clinical process or outcome makes it difficult to estimate the magnitude of their impact in health care, despite the good evidence from the primary literature that it is likely such an impact exists.

## Comfort with the system

Clinicians need to feel ownership of the electronic decision support system. This could occur by involving them in its development process.

## Availability

The electronic decision support system needs to be available at the point of care. Furthermore, such systems have to be portable, pocket-sized and available during peer-to-peer discussion, which often takes place at informal locations. If the systems are to become commonplace, they need to achieve the highest levels of reliability and they must have the capacity to keep synchronised with other data sets and latest evidence with minimum effort.

## Organisational impact

Implementation of electronic decision support systems requires significant changes in the way clinicians work. Early adopters of systems in the United States found that failure to address the major cultural impact of the system on the workforce resulted in fewer than anticipated benefits. Reasons for failure have been attributed to a failure of the systems to fit doctors' practice patterns, a lack of leadership for the implementation process, or both. Thus successful implementation must encompass a model for organisational change and not rely solely on an information technology project management model for implementation.

## Continuing education

Electronic decision support systems can provide a mechanism for continuing education. This can be done by ensuring that information on forthcoming guidelines and the new guidelines themselves are available in a timely manner and by having electronic decision support functionality support clinical audits and benchmarking to improve clinical outcomes. These facilities will enable clinicians to monitor their own performance against their peers and provide them with important feedback.

## Medico–legal issues

As yet, the legal position on electronic decision support systems is largely untested in Australia. In general, however, the extent to which the use of clinical decision support tools poses 'new' legal risks will be in direct proportion to the extent to which they generate a departure from 'normal' modes of service delivery. While the complexity of legal issues should not be overstated, and while common sense alone can solve many potential problems, it must be recognised that as these tools increase in sophis-



tication and complexity, there will be a similar increase in the complexity of the accompanying legal issues. ‘Passive’ clinical decision support tools are less likely to generate difficult legal issues than ‘active’ ones.

To an extent, these tools do little more than provide the clinicians with information that they would be able to access through other, more conventional sources. However, the special characteristic of the tools — which place them apart from conventional sources of information — is that they ‘insinuate’ themselves invisibly into the decision-making process.

This is one of the greatest benefits of the decision support technology, but from a legal perspective it is also its greatest risk. Clinicians using decision support tools may well ask themselves the following questions:

- Who creates the information that I am relying upon and what obligation do I have to find out who creates it?
- How reliable is that information and does it compare favourably with my usual sources of information? What obligations do I have to answer these questions?
- Does there exist, and if not should there exist, some independent means of verifying the quality and reliability of the product that I rely upon?
- What is my legal responsibility if my patients are harmed through some ‘inadequacy’ in the product, whether it be through an innate deficiency, a one-off deficiency in the particular tool I am using, or because of my misuse of the product?
- What is the legal responsibility of the technology-provider when things go wrong, and to what extent has this responsibility been modified or excluded by any contractual terms and conditions that it has either entered into or imposed upon me? Are those terms and conditions likely to survive scrutiny by a court?
- If the decision support technology provides me with various ‘short cuts’ by, for example, either making calculations, suggestions or recommendations, what is my legal responsibility if I disregard them? What is my legal responsibility if I depend upon them without independently seeking to exercise my clinical judgment as to the reliability of the calculation, recommendation or suggestion — the performance of so-called ‘brainless’ services? To put it another way, to what extent are the efficiencies generated by clinical decision support tools offset by my duty to independently exercise my clinical judgment?

The legal issues arising out of ‘failure to adopt’ or ‘rejection of’ decision support tools outlined above cannot be answered with any certainty at this time.<sup>10</sup>

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<sup>10</sup> Milstein B (Corrs, Chambers, Westgarth) and Togno J (Monash University School of Rural Health) *Legal Issues in General Practice Computerisation*, prepared for the Department of Health and Aged Care and the General Practice Computing Group

Furthermore, the current environment concerning medical indemnity may mean that in future, health professionals will need to be able to present stronger evidence to validate their performance. The use of electronic decision support systems will enable the better recording of decisions made by health professionals which may provide useful supporting evidence in a medical negligence case.

## 6.3 Implementation issues

### National Standards

National standards are required to support the quality, safety, efficiency and effectiveness of the decision support systems used by health care providers in providing services to consumers. By ensuring that electronic decision support systems are developed according to agreed national standards, industry will be in a better position to develop applications on a commercial scale. At the same time, to maintain Australian competitiveness, standards adopted here should conform to internationally agreed standards that are developed with Australian input.

Where there is a lack of standards and a corresponding range of proprietary solutions, this in turn leads to haphazard deployment of the solution, a staggered uptake of decision support systems and no common measurements for determining outcomes.

Standards for electronic decision support systems are required in the areas of:

- software engineering processes
- electronic decision support tools
- terminologies
- evaluation
- accreditation.

### Seamless electronic business process

Many of the benefits associated with the implementation of a national approach to electronic decision support systems depend on seamless system processes. The reality is that there are many participants and many information systems within the continuum of care, and a consistent approach is required to better realise the benefits of electronic decision support systems. This could be facilitated by:

- Adopting HL7 — the current Australian standard for health messaging — uniformly throughout Australia, making it mandatory for health messaging, and using it to

influence the process of IT14 representation and consensus. This would ensure that over time, systems would be in a better position to share information and implementation.

- Adopting common standards for the implementation, testing and updating of systems within the health care industry.
- Considering the workflow process and the interaction with systems at each point in the process.

Furthermore, the lack of maturity of other key clinical information systems (such as HealthConnect and the Better Medication Management System (BMMS)) impacts on the extent to which electronic decision support systems can be made more functional.

## Sustainability of the knowledge component

The ownership of intellectual property over information converted to electronic form will influence the extent to which there is consistency in such information available for delivery to health care professionals. If, for example, the Commonwealth enters into an agreement for clinical guidelines to be converted to electronic form, the guidelines would constitute pre-existing material for the purposes of vesting intellectual property. It is usual that the party bringing any pre-existing material into a contract retains ownership of intellectual property in that material. Therefore the intellectual property in the guidelines would remain the property of the Commonwealth, though the software used by the other party may well remain the property of that party.

In such circumstances, the Commonwealth is most likely to insist on a licence to use the software so it could maximise its ability to use the electronic guidelines. If the software itself is newly developed for the purposes of an agreement, then it is conceivable that it would form part of the contract material and therefore, ownership of it would vest in the Commonwealth.

If the intellectual property in the electronic guidelines resided in another party, then that party would have the right to adapt, reproduce, exploit and sub-license the guidelines as it chose. As many of these parties depend on their product revenue as a significant component of their funding, any considerations concerning the use of their knowledge bases in the electronic decision support systems must also address the return on the licensing or other payment method for those materials.

For example, in 1998 the Commonwealth attempted to bring together the knowledge components of the various intellectual property holders in the areas of therapies onto a single CDROM. It did not proceed because among other factors, the parties were unable to agree to a pricing framework that satisfied all the stakeholders.

## Complexity of the knowledge process

The clinical knowledge process was identified in the report of the Electronic Decision Support Governance Workshop (NHIMAC & NICS 2002) as the path from knowledge to desktop. This process needs to be coordinated at a national level because of its complex nature. Many elements (such as terminology, format and structure) need to be established in order to meet the delivery requirement through the electronic decision support system.

There are key areas of knowledge that, if addressed consistently (format, terminology and index), would significantly improve their dissemination, representation in computer form and delivery to the clinical care setting across the health sector, and accelerate the development of electronic decision support systems.

## 6.4 Level of investment

The implementation of a national approach to electronic decision support systems requires a change in the culture in which clinicians work and the creation of reliance on a new set of tools in the workplace. Electronic decision support systems offer real benefits. They are also a continuing asset that needs to be realised and managed in the same way as any other asset, with continuing investment in maintaining both the processes and system content. Currently these factors can be neglected in the future planning process of governments.

The health software industry currently lacks confidence that any future government investment or redirection of investment will not fall by the wayside. Given the length of the implementation process for most health solutions, this ongoing uncertainty needs to be addressed. A long-term commitment by governments to electronic decision support is required and could be facilitated by clear policy directions agreed to by governments.

Greater investment in the infrastructure within health facilities is needed to help meet clinicians' requirements and to guarantee the quality and safety of electronic decision support systems. It is estimated that current investment levels in information technology are between 1 and 3 per cent in the health arena. This falls far short of what is spent in other industries. Clear policy guidelines need to be formulated to ensure the long-term efficacy of health systems in Australia (Trilogy Information Solutions 2002).

Electronic decision support systems will not operate in isolation. In many instances, particularly in the acute setting, they will inter-operate with a range of other systems, such as patient administration, emergency, pathology and radiology. All these can influence the quality of the business process of using electronic decision support

systems and must be considered in the long-term view and planning process to ensure sustainability.

Governments drive the Australian electronic decision support sector. Over two thirds of projects are funded predominantly by government. However, the high costs and lack of adequate funding associated with the implementation of such systems, particularly within the hospital sector, is a severe obstacle to progress (Trilogy Information Solutions 2002).

Furthermore, the market place in Australia for electronic decision support systems is relatively small in comparison to the United Kingdom and the United States. This requires some realistic thinking by consumers of health software. Two issues often emerge.

- If a system is built that is applicable only to an Australian market it may require costly ongoing maintenance and the product may not be particularly viable for an international vendor. This is supported by the software industry's previous experiences in patient administration systems within the Australian market.
- If a system that originated overseas is used there may be considerable costs involved in reformatting it to meet Australian conditions. Again, the experience with patient administration systems and financial systems redesigned for GST confirms this fact.

The reality is that elements of both will be needed, but engaging industry early in the process may result in future savings. Further, clear directions and statements of requirement to software developers would assist in their decision making on internal innovation and investment.

Industry reports that, on the occasions it is asked to undertake information technology projects, it does not have the capacity to undertake them because of the intermittent nature of funding and the difficulty of retaining staff during lean times. The fragmented nature of the medical software industry also means there is little capacity to undertake research and development in-house. Yet electronic decision support systems of Type 2 and upwards require the use of knowledge-based technologies that are still not widespread in the information technology industry and many software developers would require research and development capacity to be in a position to develop them (Trilogy Information Solutions 2002).



# **Part B**

## **A national approach to electronic decision support development**



## 7 FUTURE DIRECTIONS FOR ELECTRONIC DECISION SUPPORT IN AUSTRALIA

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The previous part of this report (Part A) has investigated the value of electronic decision support, its deployment in Australia and the barriers to progress and uptake. The conclusions are that electronic decision support systems have enormous potential. Most of this potential has only been partially realised because much of what has been developed so far has been of Types 1 and 2 of the four types referred to earlier (section 2.3). In Australia (not unlike overseas experience), electronic decision support systems are frequently small scale, institution-based or focus on specific areas of the health system, such as general practice and pharmacy settings.

This is because, despite the evidence that these systems can lead to improvements in the quality and safety of patient care, the complex issues involved and the considerable commitment and investment needed to implement such applications on a large scale (discussed in chapter 6) make it extremely difficult to implement the systems.

Collaborating in order to adopt a national approach for developing electronic decision support systems offers considerable benefits. Information technology systems can be extremely expensive and, as there is a relatively small market here, Australia needs to be able to maximise its investments by ensuring that open architectures with high connectivity and interoperability are the hallmark in both the public and private sectors. The current projects in developing electronic decision support systems in Australia represent an investment of more than \$200 million. However, there is little coordination between most of them and few are targeted in the national priority areas for health.

The way ahead for the development and increased uptake of electronic decision support applications in Australia must acknowledge the need for national collaboration. A national approach will minimise the potential risks of ad hoc (and therefore probably incompatible) activities and initiatives in this area and maximise opportunities for achieving greater acceptance and uptake by health professionals. Furthermore, electronic decision support systems need to integrate seamlessly with personal medical record systems, such as that proposed by the national network of electronic health records — *HealthConnect* — and with the Better Medication Management System (BMMS). By working collaboratively on these initiatives with the aim of having nationally compatible systems in place, the potential for successfully implementing systems that are used is substantially increased.



## 7.1 What can be done at a national level?

The Taskforce has attempted to use the clinical knowledge process (described in section 2.2) as a way of identifying the key points in the growth and adoption of electronic decision support systems. This helps in understanding the impact of the barriers discussed in the previous chapter and points the way to future action. It also assists in determining who should be taking responsibility to ensure that the clinical knowledge process can work effectively.

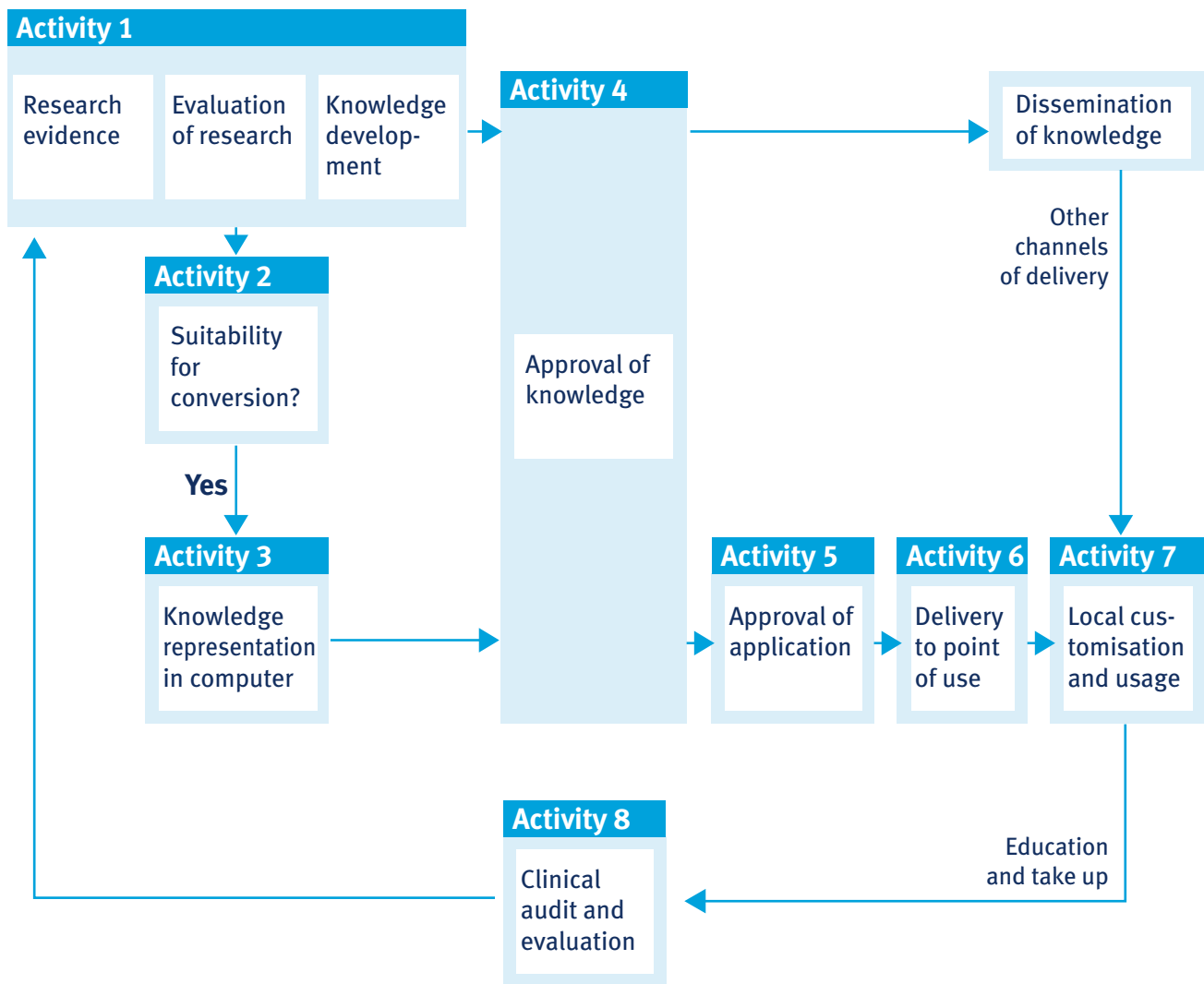
The Taskforce has classified the clinical knowledge process into eight activities (see Fig 7.1). They are:

- 1 Generation of knowledge bases.
- 2 Assessment of the potential of knowledge bases for electronic conversion.
- 3 Development of standards to guide the development of decision support applications.
- 4 Approval of knowledge.
- 5 Accreditation, testing and approval of decision support system applications.
- 6 Integration of applications with existing desktop applications using national standards.
- 7 Local customisation and deployment.
- 8 Post implementation review to ensure workability of applications, to identify specific problem areas and to (review) clinical knowledge process and release further versions of applications.

It is clear that some of these activities are already well served — such as in some aspects of 1 and 2, where the National Health and Medical Research Council has a well-defined role. Some activities of the clinical knowledge process are the province of industry, especially those concerning development of applications, interfaces with existing desktops and deployment. Aspects of 2, 3, 4, 5, and 8, however, are areas where a nationally coordinated approach can produce rewards.

The Taskforce has identified four areas of work that are intended to address those aspects of the clinical knowledge process. They are projects that can be undertaken at a national level and have a national impact wherever individual agencies or industry in Australia choose to embark on the development of electronic decision support applications.

**FIGURE 2 Classification of clinical knowledge process into activities**



These key areas of work can also have an impact on electronic decision support systems already in use by encouraging the systems to be tested against a national framework, underpinned by national standards. The four key areas of work are:

### **Foster research, development and best practice in the implementation of electronic decision support systems**

A great deal of research and development is under way in the area of electronic decision support across the public and private sectors. Given the complexities of the issues involved, research and development activities are crucial to test and prove new ideas. However, as yet there are no mechanisms for a nationally coordinated

approach to research and development for electronic decision support systems (see Sintchenko report at Appendix A).

The work of the Taskforce itself will establish a model for the operation of electronic decision support in Australia but there is always room to build on this and regenerate the model over time. To address this issue, it is proposed that work be implemented that improves particular aspects of decision support applications as they are developed.

## **Enhance the quality and safety of electronic decision support systems**

Few systems currently in operation in Australia use quality processes or quality testing as part of their development cycle to ensure that the electronic decision support systems perform correctly and safely in a clinical environment. Consequently, there is a risk that projects will either fail because they are poorly managed, or perform unsafely or unreliably when fielded in clinical settings.

To address this issue at a national level, it is proposed that a national body take responsibility for the accreditation process to ensure the quality and safety of systems at two key points. Those points are:

- in assessing the suitability of knowledge bases for conversion to an electronic decision support format
- in accrediting the clinical integrity of applications.

## **Establish a national standards framework**

Currently the health information technology market in Australia is small and fragmented and there is little guidance for software developers regarding which standards to adopt. By ensuring that electronic decision support systems are developed according to agreed national standards, industry will be in a better position to develop applications on a commercial scale.

At the same time, to maintain Australian competitiveness and in recognition of the important role of software developed overseas in the Australian health sector, standards adopted in Australia should conform to internationally agreed standards that are developed with Australian input.

A national standards framework for electronic decision support should reflect broader standards priorities. The framework should articulate the need for and role of various standards to be the foundation of electronic decision support in health, and take responsibility for supporting the development of these standards in the appropriate standards forums with the support of the National Health Information Standards Advisory Committee (NHISAC).

## Encourage an evaluation culture

Few electronic decision support projects have evaluated their systems in any rigorous or comprehensive manner. Furthermore, there is widespread variation in the evaluation methods chosen, making comparison of the effectiveness of different systems difficult. Consequently, the bulk of the investment in electronic decision support systems in Australia remains largely unevaluated.

This key area of activity proposes to initiate the establishment of an evaluation methodology to evaluate electronic decision support systems once they are in operation.

## 7.2 Support for electronic decision support systems

The above discussion shows how the clinical knowledge process works and key areas of work that can be initiated at a national level to improve its workability. In addition to proposing work that underpins the clinical knowledge process specifically, the Taskforce has examined the environment in which the process operates. In doing so, it has identified two other key areas of work that can support this environment and which, in turn, can also support the clinical knowledge process itself. These areas of work are:

### Encourage uptake and use of electronic decision support systems

The Australian health care system is moving towards a more integrated and coordinated approach to care and is placing greater emphasis on evidence-based decision making. The role of information technology in day-to-day clinical practice is becoming increasingly important for accessing and communicating health-related information. However, one of the major impediments to accelerating the uptake of information technology in the clinical workplace is a lack of support and training for individual practitioners in the use of computer hardware and software applications. Another significant factor is the role of organisational culture in facilitating and supporting the use of electronic decision support by clinicians.

These crucial factors are as relevant to the wider health information agenda as they are to electronic decision support. The work proposed in this area involves collaborating with others who are seeking both to advance the health information capacity in the sector and to encourage and support a range of capacity-building initiatives.

## **Establish national coordination and governance arrangements**

The Australian health care system is fragmented. Services straddle the private and public sectors and there are different delivery mechanisms between various parts of the country. Much of the work done in health-related online technologies has been done in isolation from similar efforts elsewhere.

This body of work explores opportunities for taking a national approach by registering projects, building partnerships and collaborating to achieve economies of scale and integration with other key areas of activity.

### **7.3 Details of key work areas form a national action plan for electronic decision support**

The Taskforce has expanded the key areas of work identified in section 7.1 and 7.2 into specific projects of work that form the basis of a national action plan as elaborated in chapter 8.

## 8 A NATIONAL PLAN OF ACTION FOR ELECTRONIC DECISION SUPPORT

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### 8.1 Foster research, development and best practice in the implementation of electronic decision support systems

#### Context

There are many sources of knowledge available to clinicians to assist them in making decisions about their patients' care. These sources are largely paper-based, but increasingly, they are becoming available in electronic versions and are accessible online.

Over the past decade there has been unprecedented interest in clinical practice guidelines and the process by which they can best be developed and implemented (NHMRC 1998). This worldwide interest has been prompted by concern about unjustifiable variations in clinical practice for the same condition, the increasing availability of new treatments and technologies, uncertainty about the effectiveness of many interventions in improving people's health, and a desire to make the best use of available health resources.

Guidelines are being designed to improve the quality of health care, decrease the use of unnecessary, ineffective and harmful interventions, and increase the use of newer, more effective interventions. In an era of evidence-based medicine (Sackett et al. 1996), guidelines are becoming one of the critical links between the best available evidence and good clinical practice.

High quality clinical guidelines and other decision support information are published by a range of organisations, including the Commonwealth, state and territory health departments, non-government organisations and commercial organisations. More than 1600 clinical practice guidelines have been written to stipulate recommendations for the appropriate delivery of care in specific clinical situations.

The effectiveness of clinical guidelines depends as much on their acceptability to clinicians and their ease of implementation into everyday clinical practice as on the scientific content of the guidelines. Consequently, consultation with the proposed user group of a set of guidelines (written or electronic) is essential in order to benefit

from local knowledge and needs and to develop the sense of ownership of the end product that is likely to result in increased use.

Regulating the quality of such vital processes and endorsing externally developed guidelines pose challenges that are now being addressed by the National Health and Medical Research Council (NHMRC 1998).

In addition to clinical practice guidelines, there is an increasing trend towards developing algorithms, clinical pathways, protocols and practice policies to assist clinicians in applying the evidence. The procedures used to develop these tools are based increasingly on a thorough evaluation of the evidence, including where appropriate, meta-analysis of published research studies on the outcomes of various treatment options, rather than the consensus of expert panels. The tools are intended to be a distillation of current evidence and opinion on best practice.

There are also several sources of objective information about appropriate use of medicines, including information on drug dosing and interactions, therapy alerts and prescribing guidelines. These include the Therapeutic Guidelines, Australian Medicines Handbook, Approved Product Information and Consumer Medicines Information. These are supported by publications such as Australian Prescriber, the Australian Adverse Drug Reactions Bulletin and the National Prescribing Service News. Protocols supporting the appropriate use of 'problem' medicines (such as anticoagulants) have also been developed (Australian Council for Safety and Quality in Healthcare 2002).

Recent feedback from Australian guideline developers highlights the important role of information technology in implementing clinical practice guidelines. Advances in technology such as the Internet and improved systems of data management and storage mean that information technology will occupy an increasingly important place in future implementation strategies. Through this technology, people can gain access to worldwide information and resources; they can locate guidelines that pertain to their health and use this important source of information in joint decision making with their health care professional; and the entire process of patient consultation can be prompted step-by-step (NHMRC 1998).

Information technology is also very amenable to use as a tool for total quality management. Evaluation and audit are important factors in developing and maintaining quality guidelines, and information technology can provide 'tagging' of patients' records in order to remind health care workers to deliver treatment in keeping with appropriate guidelines. The use of audit, made more effective by computer records, also allows feedback to users such as general practitioners. This has been demonstrated to be an effective way of inducing change in the clinical setting.

Despite this, in Australia, most electronic forms of knowledge for health professionals are data or information driven, that is, the electronic form provides base level infor-

mation that requires further processing and analysis by the health professional before a decision can be made. For example, the Clinical Information Access Program (CIAP), implemented in NSW, provides web-based access to a wide range of knowledge and reference databases, professional literature, medical textbooks and full text journals. This includes Cochrane, MIMS, Micromedex, Clinical Evidence and MedWeaver. Other states and territories have similar clinicians' health information systems. Much of the information about the appropriate use of medicines is also available in electronic format. There is, however, a lack of common access to the same information (eg there are differences between the states and territories) (Sintchenko 2002). Furthermore, these health information channels are not accessible to all health professionals.

The majority of the Type 2 electronic decision support systems currently in use have therapy planning and management as the focus of system functionality, that is, they provide information on drug dosing and interactions, therapy alerts and prescribing guidelines (Sintchenko 2002). There are many fewer systems that provide support for diagnosis, that is, operate at Type 3 or Type 4 level (Sintchenko 2002).

Thus, there is a considerable body of information that can not be accessed electronically. The main reasons for this are that there is no system for assessing whether the information is suitable for conversion into an electronic form; there are no structured approaches in place for determining which should be produced; and no framework or best practice models available that can be used for this assessment. Furthermore, there is currently no organisation that is responsible for setting priorities for this work.

The lack of a clear research and development agenda in this area has resulted in an ad hoc approach to electronic decision support systems development, depending on a range of factors, such as commercial interests, and projects, pilots and studies supported by the Commonwealth and state/territory governments, etc. A full inventory of significant projects currently under way is at Appendix A.

## Objectives

- Set a national research agenda and priorities for electronic decision support systems development in Australia.
- Develop standard best-practice models for converting clinical knowledge into electronic form.
- Encourage collaborative research projects between government, consumers, academia and industry.



## Progress to date

The National Health and Medical Research Council (NHMRC) Electronic Guidance Working Party is a sub-committee of the NHMRC Health Advisory Committee. The Working Party has been delegated the following functions:

- develop a policy on governance and quality control of health advice in electronic formats
- develop recommendations for a framework for the production, evaluation and dissemination of health advice in electronic formats
- consider available and emerging electronic strategies to facilitate the development of functionality, dissemination and use of the NHMRC approved guidelines and guidance in clinical practice
- foster the provision of health advice in electronic formats to clinicians and health care workers
- develop recommendations that, through research, education and training, will enable the necessary capacity building in electronic decision support.

The Working Party acknowledges that it is neither the role of the NHMRC nor within the NHMRC's abilities to resolve all the issues of electronic decision support and the provision of clinical and health guidance in an electronic environment. Nevertheless, the Working Party considers that much of the information already being provided in the electronic environment is far removed from actual clinical needs.

The Working Party is currently considering:

- mechanisms already in place to provide clinical guidelines in an electronic format
- the roles the NHMRC might fulfil within the broad schema of guidance in the electronic environment
- how the NHMRC can make the most useful contribution both in relation to electronic guidance and capacity building, using its currently available resources
- the new resources that might be required to implement a future role for the NHMRC.

The Working Party is also considering the available and emerging electronic strategies that are likely to facilitate the development, functionality, dissemination and use of NHMRC-approved guidelines and guidance in clinical practice.

Governance and quality control issues are a key concern of the NHMRC regarding the release of electronic guidance. Therefore the Working Party is considering the measures that the NHMRC will need to introduce to ensure that any NHMRC-approved guidelines remain identical in both content and intent when converted to an electronic format by a third party.

The NHMRC acknowledges that commercial competition is likely to prove a significant obstacle to achieving collaborative effort in the development of electronic guidance and decision support. To that end, the Working Party is exploring ways to work effectively with industry in order to maintain the integrity of NHMRC guidance while recognising the realities of the market place and the goals of the commercial world.

## Recommendations for action

- 1 A national research and investment strategy be developed for electronic decision support systems implementation by end 2003 that:
  - identifies appropriate national priorities for work
  - includes a plan on how to prioritise investment to undertake this work
  - includes a statement of national strategic directions to assist industry with its business planning
  - is cognisant of current priorities of governments that are related to electronic decision support for health care providers and consumers, including in the following areas:
    - quality use of medicines, pathology, radiology and interventions
    - electronic decision support systems development for general practice
    - rules based order management for hospitals
    - call centres
    - provision of access to online clinical information (eg CIAP)
    - development of clinical pathways, algorithms, etc. for example, in national priority areas.

### **PRIORITY - High**

- 2 Standard best-practice models be developed to assist in assessing whether clinical knowledge is suitable for conversion to electronic form — end 2003.

### **PRIORITY - High**

- 3 A regulatory and national investment framework be established that allows for the development of sustainable business models by health information industry participants.

### **PRIORITY - Medium**

- 4 A program that encourages collaborative projects be initiated between government, consumers, academia and industry — June 2004.

### **PRIORITY - Medium**

## 8.2 Enhance the quality and safety of systems

### Context

Electronic decision support systems are designed to support health care professionals in the normal course of their duties. Electronic decision support systems assist in decision-making tasks where humans are challenged because of the complexity of the decision, the amount of knowledge needed to be mastered, or because the pressure of work can increase the likelihood that errors will occur.

However, unlike paper-based clinical practice guidelines that can be accredited through the processes of the National Health and Medical Research Council, the knowledge base information underpinning electronic decision support systems is not currently scrutinised through a formal accreditation process. Rather, such information is developed largely by knowledge agencies with the assistance of expert clinical panels. Furthermore, this information is often implemented in electronic form for use in a particular health sector (eg a hospital setting) or for a single purpose, such as a pilot or research project, and therefore, it is not possible to transfer and use this information in other health care settings.

### Computerised drug alerts systems

To date, the most experience with electronic decision support systems has been with prescribing. However, in terms of drug information, software varies greatly in respect of its reliability and quality. There are marked differences across systems in the interactions identified and their severity/significance levels in those systems in which interaction grading is provided.

The Better Medication Management System Drug Alerts Discussion Paper (BMMS Implementation Taskforce 2002) identifies shortcomings in current drug alerts systems provided by five prescription writing and five prescription dispensing software packages that were investigated as part of the process of developing the paper. The paper states that while a number of the medical software programs investigated use commercially available drug interaction databases, for example the MIMS and MICROMEDEX, most suppliers of pharmacy software have developed and maintain their own interaction databases. This is a reflection of the fact that when dispensing software was first developed, there were no electronic interaction databases available commercially. Interaction databases developed by software vendors rely on interaction data sourced by pharmacists and doctors from a wide range of references, including manufacturers' Product Information and a number of standard drug interaction texts. Thus there is most likely to be variation in the interactions detected by the checking facilities across

the different packages and in the severity/significance levels of these in those systems in which interaction grading is provided. The extent to which this occurs is not known.

Product Information about drug interaction varies markedly. There is some user concern about the reliability and clinical importance of published descriptions of actual and potential interactions and therefore about the information included in the non-standard databases provided by software companies.

According to the BMMS discussion paper, one of the main problems with prescribing and dispensing drug alerts systems is the significant volume of information presented to users that must be processed in order to make informed decisions several times during a busy day or work session. Warnings are not always helpful and in fact are inappropriate on occasions, for example, when an interaction that is correct for an oral or injectable presentation of a drug, is identified for a topical or inhaled presentation. This will occur where interactions are based only on drug classes or groups and are not undertaken at individual drug product level.

The BMMS discussion paper suggests that some interaction database developers attempt to provide comprehensive drug interaction databases by including in them, theoretical and minor drug interactions in addition to those interactions identified as highly and moderately significant. Use of these databases thus results in the frequent display of warnings for interactions that are either unlikely to occur or are of such insignificance that there would be no clinical effect should they actually occur. In the developers' defence, however, there are still relatively few data regarding the likelihood that an adverse drug event will occur when two medications that potentially interact are given together.

The paper also notes that while some anecdotal evidence suggests that some doctors are disabling the drug interaction checking facility in their desktop software, no formal research has been undertaken to test these claims or to identify why this should occur. The BMMS Development Group has recommended that this research be undertaken. In addition, there are complaints by doctors and pharmacists of the irritating nature of the display of clinically inappropriate drug alerts that have a negative impact on their workflows. There is also anecdotal evidence that when doctors and pharmacists become used to unimportant and clinically irrelevant warnings, they tend to ignore them or often turn them off — at least mentally — and in so doing, run the risk of subsequently failing to notice and review warnings of significant potential interactions. This is more likely to occur when using software that does not grade interactions or allow the disabling of minor/insignificant potential interactions.

The paper further notes that concern has also been expressed about the maintenance of drug interaction databases. There is currently no mechanism or process by which up-to-date post-marketing interaction information is readily available for inclusion in these databases.

Of particular concern is that standard software development techniques that ensure the accurate representation of such information in computerised form are often overlooked and the information itself is not accredited or checked for compliance with standards in best practice. Few systems used currently in Australia use quality processes or quality testing to ensure that the electronic decision support system performed correctly and safely in a clinical environment. Furthermore, there is a lack of awareness of what such process standards might be (Sintchenko 2002).

Consequently, there appears to be a substantial gap in the quality process in electronic decision support projects in Australia, raising the risk that projects will either fail because they are poorly managed or will perform unsafely or unreliably when fielded in clinical settings.

## Objectives

- Ensure the development of quality electronic decision support systems that perform accurately and safely in a clinical environment.

## Progress to date

The National Prescribing Service (NPS) is a non-profit organisation with broad stakeholder representation that operates independently of the pharmaceutical industry and the government. The NPS was formed in March 1998. Its mission is to ‘create an awareness, culture and environment for all stakeholders that will support quality use and prescribing of medicines’, with the ultimate goal of improving the health of all Australians through the Quality Use of Medicines (QUM). The NPS has a number of key strategic objectives, but the major one focuses on service delivery and the QUM for health professionals. The NPS run a number of programs that focus on this important area, including the Pharmaceutical Decision Support Program.

The main aim of the Pharmaceutical Decision Support Program is to facilitate access to best evidence and decision support materials at the point of decision making — including providing evidence-based information about drugs — in addition to electronic integration and delivery of quality assurance and educational activities for all doctors and pharmacists.

To help achieve these aims a Decision Support Working Group has been established to provide strategic advice to the NPS Board and NPS Decision Support Program regarding:

- the development of NPS activities in electronic pharmaceutical decision support to medical practitioners, pharmacists and consumers
- electronic delivery of NPS interventional strategies to promote QUM

- identification of areas of opportunity for implementing programs to promote QUM for medical practitioners, pharmacists and consumers.

The group also works with the medical software industry so that NPS consumer resources are incorporated into prescribing and dispensing software.

The BMMS Implementation Taskforce commissioned the development of a paper (BMMS 2002) that provided it with the comprehensive and relevant information it needed to make fully informed recommendations about the further development of drug alerts systems. The paper considers only the drug-to-drug and drug-to-adverse-reaction/allergy checking aspects of electronic decision support in prescription writing and dispensing desktop software used by doctors and pharmacists in both community and hospital pharmacy settings. The paper:

- examines the various ways in which these checks are currently undertaken in prescription writing and dispensing desktop software
- considers issues of reference terminology, text for drug descriptions and standards
- identifies relevant initiatives and projects in electronic decision support
- identifies and considers projects that could enhance the operation of drug alerts systems.

The General Practice Electronic Decision Support (GPEDS) Initiative will build on current quality initiatives, such as the Quality Use of Medicines program. The expectation is that over time, this initiative will support general practitioners in making more informed decisions about prescribing, diagnostic referrals and care delivery based on up-to-date information.

In the short term, the initiative will provide information to doctors about the full cost to government of medicines prescribed under the Pharmaceutical Benefits Scheme. This phase of the initiative will also address the cost of pathology and diagnostic referrals with a view to ensuring that general practitioners have access to full and up-to-date information on these costs at the point at which referrals are made. In the longer term, the GPEDS Initiative will seek to improve general practitioners' access to, and use of, authoritative evidence-based clinical guidelines.

The General Practice Computing Group (GPCG) has identified an activity to be progressed under phase one of its work program which is to undertake a feasibility study into establishing a health-sector-wide software accreditation scheme. It is expected that this activity will include broad consultation with health sector stakeholders. Currently the GPCG Management Committee is considering the breadth of the project.

## Recommendations for action

- 5 A framework of standards and procedures be developed by end 2003 for accrediting particular clinical knowledge bases.

**PRIORITY – High**

- 6 A formal process be established by mid 2004 to accredit desktop software whereby a recognised body would perform a specified level of testing against predefined criteria and standards, including in the following areas:

- adherence to technical standards
- conformance with standards for development
- adherence to standards for functionality testing
- conformance with standards for re-accreditation.

**PRIORITY – High**

- 7 A priority list of medication alerts to be developed for use in electronic decision support systems in a range of clinical settings — by end 2003.

**PRIORITY – High**

- 8 All government funded projects to adopt best-practice standards — by mid 2004.

**PRIORITY – High**

- 9 A register of accredited clinical knowledge bases be established — by end 2004.

**PRIORITY – Low**



## 8.3 Establish a standards framework

### Context

It has been recognised that in the health sector, knowledge generation does not automatically translate to real-world uptake and practice (Cesnik 2002). This is a major barrier to the provision of high-quality, safe and efficient health care. Studies have shown that health care practices vary widely within the sector and do not necessarily conform to best practice. The large volume of research literature and rapidly evolving medical knowledge exacerbates this problem. Clinicians find it difficult to keep pace with recent developments in best practice. It can also be difficult to apply ‘paper’ clinical guidelines and protocols to the delivery of care.

As the previous discussion has illustrated, electronic decision support systems and tools offer the potential to address these issues through the provision of evidence-based tools and knowledge at the point of care. However, to date the development and use of electronic decision support systems within the health sector has been patchy. Electronic decision support systems are currently developed in a proprietary manner and are generally ‘hard wired’ into systems that manage patient information. The incorporation and maintenance of knowledge within these systems is resource intensive. This has limited the development of clinical electronic decision support systems and has implications for the quality and safety of existing systems.

The lack of agreed health information and knowledge representation standards has been identified as one of the major barriers to the development and use of clinical decision support tools in the Australian health sector, and has contributed to the fragmented nature of electronic decision support systems development (Cesnik, B 2002).

Work on the development and implementation of information standards in health is currently being progressed at the national level. *Setting the Standards: a National Health Information Standards Plan for Australia*<sup>11</sup> outlines a national workplan to progress the development and use of health information standards. It includes work in the areas of:

- messaging and communication
- data standards, coding and classification
- privacy, security and access control
- provider and consumer identification
- electronic health record architecture and clinical models.

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<sup>11</sup> [www.health.gov.au/healthonline/sp.index.htm](http://www.health.gov.au/healthonline/sp.index.htm)



The development and implementation of standards in these areas will benefit the development and use of electronic decision support systems in the health sector through better integrated health information systems, and better technical and semantic interoperability generally.

In terms of ensuring the quality and safety (and indeed the viability) of electronic decision support systems, the literature identifies standards in the areas of reference terminology, identification and knowledge representation as critical (NHIMAC & NICS 2002; Walus, Ittmann & Hammer 1997). Knowledge representation standards are needed to allow the development and sharing of knowledge in computable formats. This will improve the quality and efficiency of electronic decision support systems development. Terminology standards will also facilitate the development of higher-quality electronic decision support systems and will enable the development of more sophisticated, patient-centric tools. In addition to these identified standards, electronic health record standards will be critical in supporting more sophisticated decision support systems (types 3 and 4), as the electronic health record will provide the source of patient data upon which many of these systems will provide decision support.

## **Standards vital to electronic decision support: an overview**

### **Knowledge representation**

Knowledge representation standards enable knowledge (for example in the form of clinical practice guidelines, clinical protocols, reference materials) to be represented in a way that allows computer processing.

The lack of knowledge currently available in a format that allows direct integration into software has been identified as a major barrier to the development of electronic decision support tools in health. Clinical knowledge is currently developed and presented in a ‘flat’ format and to convert this knowledge into a format that can be integrated into software is time-consuming and expensive, especially given the large volume of clinical knowledge and its evolving nature.

An example of the challenge this presents to software developers is the integration of best-practice guidelines into electronic decision support products. Guidelines are currently produced as text documents and often contain internal inconsistencies and ambiguity that makes their conversion into interactive electronic decision support tools difficult.

The consequence of this is that the development of knowledge in a form that allows integration into electronic decision support systems is done in a proprietary manner, and knowledge developed in computable formats is not shared between software developers. Given the expense of developing this information and the difficulties

posed by keeping such information up to date, the current management of knowledge represented in computer-friendly formats has implications for the quality and safety of systems and the efficiency of electronic decision support systems development.

A number of knowledge representation standards and associated tools have been developed internationally. These include Guideline Interchange Format (GLIF, which incorporates Arden Syntax rules), Guideline Elements Model (GEM), PROforma, Prodigy and ASBRU. These tools provide 'rules' for the representation of clinical knowledge. Implementing standards in the area of guideline representation will allow information to be shared between software developers. This was recognised at a national workshop in 2001, which reported that '... with the adoption of standards, industry could more readily incorporate electronic decision support into their products without having to duplicate each others efforts as well as taking on responsibilities for currency, accuracy, and other issues' (NHIMAC & NICS 2002).

However, the promotion of standards in this area and the expectation that the development of knowledge in standard formats will be shared has implications for the provision of resources or incentives to facilitate the participation of the health IT sector in the development, maintenance and dissemination of open-source 'computer friendly' knowledge.

Knowledge representation standards provide a critical link in enabling knowledge to be translated into computer processable formats. In terms of actively pursuing this standards agenda, two points should be noted. First, the majority of development work is happening overseas. Second, development of knowledge representation standards (and particularly those that will be essential to support type 3 and 4 decision support tools) is at an early stage internationally. This provides the ideal opportunity for Australia to contribute to and capitalise on international work, and highlights the importance of Australian involvement in the development of international standards in this area.

### **Patient identification**

The ability to unambiguously identify patients has been recognised as critical to the success of electronic decision support systems that draw on patient information contained within databases or from disparate sources. In particular, the ability to identify and bring together patient information is critical in the context of electronic decision support tools combined with electronic health records.

### **Reference terminology**

The adoption of common terminologies and semantics (structured vocabularies) by all is a fundamental requirement to optimise knowledge retrieval (Elkin, Brown and

Chute 2001). Standard reference terminology is required to support the development of electronic decision support applications. It is important that information used by electronic decision support systems to formulate advice or guidance be unambiguous, to ensure the safety and quality of information produced by such systems.

A good example of the importance of reference terminology is provided by the possible role electronic decision support may play in detecting potential drug–disease interactions. The prescription of drugs contraindicated due to physiological factors (eg kidney function) is recognised as a major cause of adverse events. In many cases, the knowledge to prevent inappropriate prescribing is available, and given a set of rules regarding recommended prescribing behaviour and pathology results and other patient-specific information, many of these potentially harmful adverse events could be prevented through an alert system. However the lack of standard terminology for both patient and drug information is a major barrier to the development of such tools.

Reference terminology issues are critical to the integration of health information systems generally, and are central to the development of effective, sophisticated electronic decision support. Until terminology issues are addressed, it will be difficult to develop sophisticated clinical electronic decision support.

## Objectives

- Facilitate the development and uptake of standards to enable electronic decision support.
- Support the development of partnerships between the health IT sector and developers of clinical knowledge.
- Ensure (where possible) that standards adopted in Australia align with international standards.

## Progress to date

The National Health Information Standards Advisory Committee (NHISAC) was established by NHIMAC in October 2000 to advocate the adoption of national standards relevant to health information. In February 2001, NHISAC published *Setting the Standards: A National Health Information Standards Plan for Australia*. The plan provides an overarching strategy to support the development and implementation of health information standards nationally. Activities currently being progressed according to the workplan set out in *Setting the Standards* include:

- the development of a health messaging strategy for Australia
- the development of electronic health record requirements

- the development of consumer and provider identification
- the development of a national, strategic approach to health terminologies.

The NHISAC work program will support the development of standards-based electronic decision support systems. To date, little work has been progressed at a national level in terms of a strategic approach to knowledge representation standards. This is an area where national direction could provide a vital driver for the development of electronic decision support, and needs to be addressed as a priority in this context.

### Recommendations for action

- 10** Agreement be gained among key stakeholders on the detailed requirements for clinical knowledge representation methodologies to facilitate the representation of clinical guidelines, rules and protocols in electronic software — by end 2003.

**PRIORITY – High**

- 11** NHISAC and associated standards-making bodies ensure that the needs of electronic decision support in relation to standards development are taken into account in developing standards policies and projects — ongoing.

**PRIORITY – High**

- 12** The Taskforce's recommendations concerning standards development for electronic decision support be taken up in the next edition of the *National Health Information Standards Plan for Australia* — end 2003.

**PRIORITY – Medium.**

- 13** Australian participation be facilitated in the development of standards for clinical knowledge representation, which is largely being undertaken internationally — ongoing.

**PRIORITY – Low**

## 8.4 Encourage an evaluation culture

### Context

There is little evidence that electronic decision support systems are evaluated in any rigorous or comprehensive manner. Amongst those that have attempted formal evaluations, most concentrated on user acceptability of the system, rather than attempting to measure improvements to clinical processes or outcomes. Further, there is widespread variation in the evaluation methods chosen, making comparison of the effectiveness of different systems very difficult. Consequently, the bulk of the investment in electronic decision support systems in Australia remains largely unevaluated, and it is not possible to make clear statements about costs and benefits on the absence of any evaluation data. There are various reasons for this failure to evaluate. A critical one is lack of funding — it is either not being made available or reasonably allocated, indicating that funding bodies and software developers may not be giving evaluation a high enough priority.

### Objectives

- Evaluation of efficacy and effectiveness of electronic decision support systems is undertaken as a matter of course and use a rigorous and validated methodology.

### Progress to date

There has been no activity at the national level. Some evaluation activities are under way as a component of specific projects, however, this has resulted in widespread variation in the evaluation methods that were used.

#### Recommendations for action

- 14 An evaluation methodology be developed to ensure that evaluations use rigorous and validated methods and that their results are robust and permit across-project comparisons — by end 2003.

**PRIORITY – High**

- 15 Make evaluation a required component of any government funded electronic decision support program, including ensuring that sufficient funds are set aside to adequately resource such evaluation — by end 2003.

**PRIORITY – High**

## 8.5 Encourage uptake and use of electronic decision support systems

### Context

The greater uptake of electronic decision support applications by health providers, coupled with increased opportunities for training and support of health care workers on the use of such applications, will help to achieve significant improvements in the quality of care delivered for consumers. It is unreasonable to assume that clinicians should be fully up-to-date with the management of every clinical situation, given the rapid pace of developments in drug therapy and ‘best practice’. Continuing medical education (CME) helps to overcome the deficits that might otherwise occur between what is determined to be optimal care and what is actually practised ‘in the field’. The use of decision support systems that incorporate the vast array of clinical guidelines, up-to-date information on drug therapy and prescribing, act both as educational tools for practitioners and their patients and as a means to improve the quality of patient care.

Much of the focus to date, however, has been limited to general practitioners. The Taskforce proposes that future work should include identifying the key infrastructure, standards and socio-technical barriers that exist for other health care providers and developing workable incentives to increase uptake of information technology.

Education and training are also important issues to be addressed as part of the overall uptake of information technology. Already, states and territories have recognised the importance of equipping students with information technology skills so that they can participate in the broader information economy. This will be critical in bringing about generational change.

However, one of the major impediments to accelerating the uptake of information and communication technologies in the health sector is a lack of support and training on the practical application of computer hardware and software applications. The information technology skill base amongst many health care professionals is low, and opportunities to enhance their knowledge in this area has been impeded by a lack of any ready support in day-to-day situations, as well as the lack of any relevant training opportunities. Activities that make electronic decision support systems easier to use and give health professionals greater understanding of how information systems function in the workplace can encourage them not only to use computers in their practice, but also accept information systems as beneficial.

There is also a large gap between the increasing demand for the design, evaluation and implementation of information and communication technologies in the Australian health system, and the available skill-base.

## Objectives

- Foster increased participation by consumers and providers in the use and uptake of quality electronic decision support systems.
- Support the development and delivery of community information, education and training to inform and educate consumers and providers in the use of electronic decision support systems.

## Progress to date

The Federal Minister for Health and Ageing recently approved the General Practice Computing Group (GPCG) Work Program Phase One, which allocates \$1.9 million to a range of practical projects aimed at operationalising the goals of the GPCG's Strategic Framework. A key strategy for the GPCG is that general practitioners have access to relevant and up-to-date diagnostic and treatment information on their computers. The Phase One Work Program includes a proposed project to investigate the opportunities for greater use of electronic diagnostic and treatment information, and to test its effectiveness on patient outcomes. It is expected that this project will be completed by 30 June 2003.

The Integrated Care Program (ICP) commenced in June 1998 and aims to assist general practitioners (GPs) in their clinical management of diseases, through the development of electronic decision support software based on evidence-based best practice guidelines. The overall aim of the program is to demonstrate that evidence-based best practice implemented within the general practice setting can optimise patient outcomes, improve the efficiency of resource allocation and impact on health policy development and decision making. Phase 1 saw the development of three GP desktop electronic decision support system modules to treat asthma, depression and congestive heart failure.

ICP Phase 2 commenced in September 2001 and aims to further develop the asthma and depression modules clinically, technically and methodologically. It is expected that the development of the electronic decision support framework will begin in September 2002, with the software components completed by early next year. The clinical specifications have been developed for the asthma module and are ready to be incorporated into the framework. The depression clinical specifications are currently being finalised to reflect the Better Outcomes in Mental Health initiative and will be incorporated into the framework once this has been achieved. Once the software is developed, a 9–12 month trial will be undertaken. A comprehensive evaluation framework has been developed to evaluate the trial and the electronic decision support system. Phase 2 is scheduled for completion in June 2004.



The 2001–02 Federal Budget announced a range of Chronic Disease Initiatives and funding to Divisions of General Practice to support their implementation. The funding also requires Divisions to identify activities that will promote the role of information management and information technology in general practices as a means of effectively implementing the Budget measures. This is an effort to overcome concerns raised by the Divisions around further funding for information technology officers, which ceased on 31 December 2001. To achieve an effective blend between the chronic disease initiatives and information management and information technology activities, the Commonwealth Department of Health and Ageing varied and extended the previous information management and information technology Funding Agreements with Divisions for 18 months (ie until 30 June 2003).

While some Divisions have opted to retain information technology officers to meet the terms of the Agreement, others are now moving to incorporate information management practices as part of their core business through other mechanisms. This approach is consistent with the work undertaken in general practice over the past 12 months to communicate the potential benefits that information management and information technology can bring to general practitioner's clinical work and practice management. The Australian Divisions of General Practice also received funding to engage an information management coordinator to promote the use of information management and encourage Divisions (and general practitioners) to adopt information management practices in their clinical work and practice management. The communication function is now being broadened to include the Chronic Disease Management initiatives.

The Australasian College of Health Informatics (ACHI) was established in August 2002 to inform the development of professional standards and practice. The College was created to oversee the development of a national focus for training and research involving health informatics in Australia.



## Recommendations for action

- 16** A study be undertaken of the extent of use of current systems and the barriers to the use of such systems — by end 2003.

**PRIORITY – Medium**

- 17** A review be undertaken on the impact that electronic decision support systems have on the day-to-day workflow of health professionals and best practice models be developed to assist them to improve workflows and work practices — by end 2003.

**PRIORITY – High**

- 18** The inclusion of training in the use of electronic decision support be promoted in health-related undergraduate and post-graduate courses by liaising with university departments, colleges and professional associations — by end 2003.

**PRIORITY – Medium**

- 19** A national communications strategy be implemented to encourage uptake of electronic decision support systems, including the development of a community information strategy and national communications materials — by end 2003.

**PRIORITY – Medium**

- 20** Electronic decision support be promoted to learned bodies in the health sector — by end 2003.

**PRIORITY – Low**

## 8.6 Establish national coordination and governance arrangements

### Context

Despite the fact that there are many electronic decision support systems projects under way in Australia, there is little coordination between most of them and few are targeted in national priority areas for health. A coordinated national approach is needed if Australia is to maximise the potential of emerging information and communications technologies to develop quality electronic decision support systems for the benefit of health professionals and consumers. Furthermore, a coordinated approach enables projects with similar aims to share experiences and pool funds and reduces the risk of duplicating effort.

### Objectives

- Coordinate the strategic direction, vision and policy recommendations on behalf of governments through AHMAC and Health Ministers.
- Increase necessary synergies among jurisdictions by sharing resources and reducing unnecessary duplication of effort.
- Encourage communication between existing and new players with an interest in electronic decision support systems development.

### Progress to date

There are positive examples of inter-state cooperation at a government level. The Clinical Information Access Project (CIAP) from NSW Health has influenced the development of similar online evidence assess systems on the other states. Two states, Victoria and Queensland, have subsequently joined NSW in contractual agreements, achieving significant economies of scale in purchasing knowledge databases. A national forum meets annually to share experiences with online evidence systems.

## Recommendations for action

- 21** Coordination between electronic decision support project teams be encouraged by establishing an interim governance entity to manage and coordinate electronic decision support activities in Australia — by mid 2003.

**PRIORITY - High**

- 22** A clearinghouse of electronic decision support projects be established by end 2003 that:

- maintains a bibliography of reports on projects in Australia
- details new projects and significant investments made in electronic decision support systems
- provides evaluation reports to disseminate information about the efficiency and effectiveness of electronic decision support projects
- lists professional experts in key areas.

**PRIORITY – Medium**

- 23** An annual electronic decision support forum or conference be held to encourage interaction amongst stakeholders, to share experiences and to encourage the building of networks.

**PRIORITY – Low**

## 9 IMPLEMENTATION OF THE NATIONAL ACTION PLAN AND GOVERNANCE ARRANGEMENTS

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Chapters 7 and 8 describe a national action plan for implementing aspects of the clinical knowledge process at a national level. Implementation is clearly not a simple task and much of the work in this area is relatively undeveloped. There is also no governance arrangement currently in place that can initiate this work and bring it to fruition.

In recognising these complexities, the Taskforce proposes a two-stage approach to implementation. The two stages are:

- Stage 1: Undertake developmental activities outlined in the National Action Plan (years 1–2).
- Stage 2: Operationalise the National Action Plan in full.

### 9.1 Governance

There are significant benefits in a national approach to the development of electronic decision support systems. Such an approach needs to be developed in a considered way. Stage 1 of the two-stage approach described above is intended to establish many of the foundations needed to enable a more consistent and coordinated approach to the development of electronic decision support systems. Stage 1 focuses on establishing the environment in which all stakeholders can operate.

The Taskforce's view is that work should proceed immediately on Stage 1. It considers that preparatory work can be undertaken that would be an important investment even if the proposed Stage 2 of implementation were not to proceed as proposed. The Taskforce therefore suggests that, as a transitional arrangement, an interim National Implementation Unit be created and jointly resourced and staffed by the Commonwealth, states and territories. The role of the unit would be to commence work on Stage 1 of implementation as described above, without committing resources on a scale that will require budget appropriations.

The Taskforce considered four options for appropriate bodies to oversight the work of the interim National Implementation Unit in years 1–2. The four options considered by the Taskforce were:

- *National Institute of Clinical Studies.* The National Institute of Clinical Studies (NICS) is Australia's national agency for translating health care knowledge into practice. It is funded by the Commonwealth Department of Health and Ageing. The Institute's mission is to work in partnership with consumers, health professionals and organisations, researchers and governments, to close the gaps between evidence and clinical practice, in those areas that will effect significant change for the Australian community by providing practitioners and health organisations with systems that will assist them to improve the health outcomes of those within their care.
- *National Health and Medical Research Council.* The National Health and Medical Research Council consolidates within a single national organisation the independent functions of research, funding and development of advice. It brings together and draws upon the resources of all components of the health system, including governments, medical practitioners, nurses and allied health professionals, researchers, teaching and research institutions, public and private program managers, service administrators, community health organisations, social health researchers and consumers. The Council's functions come from the statutory obligations conferred by the *National Health and Medical Research Council Act 1992*.
- *National Health Information Management Advisory Council.* The National Health Information Management Advisory Council was established by Australian Health Ministers to advise them on options to promote more effective information management (including the application of information technology) within the health sector.
- *Australian Council for Safety and Quality in Health Care.* Australian Health Ministers established the Australian Council for Safety and Quality in Health Care in January 2000 to lead national efforts to improve the safety and quality of health care, with a particular focus on minimising the likelihood and effects of error. The Council reports annually to Health Ministers.

Of these options, the Taskforce considers that the National Institute of Clinical Studies would be the most appropriate body to project manage the work of the interim National Implementation Unit in years 1–2. The Institute is already a joint leader in this process with the National Health Information Management Advisory Council, and the work that the implementation unit will be doing is directly related to the Institute's core business. It is a relatively new independent organisation with a strong clinician focus. The Institute has made good progress in closing the gap between research evidence and clinical practice. On this basis, it would be well accepted by stakeholders. In making this recommendation, the Taskforce acknowledges that the Institute is currently the subject of a review and its future role is uncertain at present. The Taskforce also acknowledges that the Institute's Board needs to consider and endorse this proposal.

While the Institute is considered the best-placed organisation to oversight the work of the interim National Implementation Unit, it is important that this work be undertaken in partnership with the National Health Information Management Advisory Council, the National Health and Medical Research Council and the Australian Council for Safety and Quality in Health Care to ensure that the next stage benefits from the expertise developed through the Taskforce process. In any arrangement to carry this forward it will be critical that people with the appropriate expertise from the States and the Commonwealth who already have an involvement in this area are able to continue to make a major contribution.

Stage 2 concerns making the National Action Plan fully operational. At this point, the most gains would be realised in terms of improving the safety and quality of knowledge bases underpinning electronic decision support systems through a process of accreditation. At Stage 2, work would be under way to accredit knowledge bases by an accreditation agency. The knowledge bases would need to comply with standards and best practice models and evaluation requirements. To this end, the Taskforce recommends that the overall coordination and governance of the National Action Plan in the longer term be the responsibility of a national body that has the necessary power and responsibilities to carry out the full work program and to exist on an ongoing basis to provide the intervention required at key points of the clinical knowledge process. A national body could be part of an existing organisation, such as the National Institute of Clinical Studies or the National Health and Medical Research Council, especially in light of concerns expressed by stakeholders about the creation of a further national body. However, the Taskforce's view is that existing national organisations are not currently structured in a way that would allow them to take on this responsibility.

## 9.2 Governance roles

The establishment of a national body to exist for the longer term will be a major undertaking. The task will require cooperation between the Commonwealth and state/territory governments and the involvement of all major stakeholders. Governance of the development and operation of the national body will be a substantial undertaking in its own right and will need to encompass the interests of a diverse group of stakeholders.

There are two options for the stage of the process in which knowledge is represented in the rules of electronic decision support systems. In the first option 'the centralist option', a single organisation is authorised to acquire the knowledge and convert it into rules for the system under licence from the knowledge owners. The price of the licences would have to be set by regulation.

In the second option, ‘the marketplace option’, the national peak body only uses standards to cover the rules development stage. The standards then operate in an open marketplace of the knowledge owners.

If the national body were established and followed the centralist model, then what is required is likely to be akin to the model operating in the United Kingdom. This model implies that an additional organisation is required to undertake the role of generating rules. This organisation should be separate from the peak body but should be accountable to it under contract.

In either situation, the national body needs to establish a process of accreditation of the final electronic decision support systems. Accreditation will cover how the rules-based knowledge is incorporated into the range of computer systems that form the Australian electronic decision support systems marketplace.

## 9.3 Governance options

The report *A Health Information Network for Australia* (National Electronic Health Records Taskforce 2000) identified options available for the governance of a Health Information Network for Australia. These options are equally applicable for the national body proposed for governing the National Action Plan. They include:

- a statutory authority within the Commonwealth Health portfolio
- a separate organisation/business enterprise accountable to Australian Health Ministers
- a private sector organisation.

An example of the first option would be the National Institute of Clinical Studies or the Australian Institute of Health and Welfare, which sit within the Commonwealth health portfolio and report directly to the Federal Health Minister. However, this option, runs the risk of not being sufficiently representative of other jurisdictions’ interests.

The second option includes two possible sub-models for establishing the governance body:

- an independent, for-profit company with shares being held by stakeholders — in this case Commonwealth, state and territory governments and other stakeholders
- a non-profit company limited by guarantee in which the Commonwealth, states and territories and other stakeholders would be represented in proportion to their contribution. The National Prescribing Service, set up with the aim of improving prescribing practices, is an example of such a body.

The first of the sub-models would be less attractive as it could be distrusted by many stakeholders who would see a profit motive as incompatible with the provision of an equitable service to a wide range of users. Profit would be generated by selling information and this may exclude or burden some users, particularly consumers, who would be the source of information in the first place.

The second of the sub-models, a non-profit company, would provide the independence from any one jurisdiction, allow representation from all sectors and could have a sufficiently robust constitution to allow it to function with a reasonable level of autonomy. At the same time, stakeholder participation through guarantor arrangements would allow stakeholder groups to have ownership and actual buy-in to the whole developmental process. The Commonwealth Department of Health and Ageing would have an important role in the management of the company, but presumably its influence would be balanced by provider and consumer interests.

The third option listed above, that of an entirely private sector organisation, would run the risk of not adequately representing government and public sector interests — the same issues raised under the for-profit sub-model above. Clearly, the public sector, which is currently responsible for funding two-thirds of the total annual recurrent expenditure on health services, needs to have a key role in ensuring that the governance arrangements adequately protect public interests.

In summary, the Taskforce's view is that the best option for governance is based on a non-profit organisation with limited liability and with stakeholders participating under guarantor arrangements — with majority ownership in the public sector.

The Taskforce is mindful that processes currently under way at the national level are undertaking a more general review of the governance framework for the health information agenda. The outcomes from these processes would need to be considered before a final recommendation can be made about whether an existing national body can take on the responsibility of managing and coordinating electronic decision support development or whether a new national body needs to be created. Therefore, the Taskforce recommends that the longer-term governance arrangements be confirmed within the next year once other governance issues are resolved.

Furthermore, the Taskforce sees value in considering the option of bringing together the governance arrangements for electronic decision support development with that proposed for *HealthConnect* (if it proceeds to a national roll-out) and the Better Medication Management System. Electronic decision support systems need to integrate seamlessly with electronic health records. Bringing these functions together under one governance umbrella creates the opportunity to have nationally compatible systems that are used more effectively and efficiently by health care professionals.



## Recommendations for action

- 24** Immediately commence work to progress the recommendations for action set out in the National Action Plan (chapter 8).

**PRIORITY - High**

- 25** Pending approval from the Board, establish an interim National Implementation Unit located within the National Institute of Clinical Studies (NICS) to be responsible for managing and coordinating the implementation of the National Action Plan.

**PRIORITY - High**

- 26** The National Implementation Unit to review the longer-term governance requirements necessary for ensuring a nationally coordinated approach to the development of electronic decision support systems by end 2003 — having regard to other processes that are currently in train that concern national governance arrangements for health information issues.

**PRIORITY - Medium**

## 10 BENEFITS AND COSTS OF IMPLEMENTATION

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This chapter addresses the likely benefits and costs attributable to the Taskforce's proposal to establish an interim National Implementation Unit and implement the National Action Plan (see chapter 9).

### 10.1 Benefits

Chapter 4 canvassed the expected benefits of electronic decision support systems in some detail. In brief, electronic decision support is seen as a key mechanism to enable health professionals to provide high-quality health services to consumers. It is expected that electronic decision support systems designed to aid health care providers when making important decisions will ultimately improve patient outcomes.

There is substantial evidence of the effectiveness of electronic decision support in improving the safety, quality and efficiency of health care. Electronic decision support can contribute to improved patient safety through reduced medication errors and adverse events, and improved medication and test ordering. There is potential for electronic decision support to contribute to improved quality of care through increased application of clinical pathways and guidelines and greater use of up-to-date medical evidence. There is also potential for greater efficiency in health care delivery to be achieved through faster order processing, reductions in test duplication, decreased adverse events, and changed patterns of prescribing towards less costly generic brands.

Overall, the available evidence regarding the impact of electronic decision support systems on delivering improvements in the quality, safety and efficiency of health care is promising. However, there remains a need to continue to monitor and evaluate the implementation of electronic decision support systems to build the evidence base and ensure that the full potential of these systems is realised.

### 10.2 Costing the National Action Plan

Experience with other health information initiatives has shown that government is best placed to bring about change and accelerate the pace of reform, in partnership with key stakeholders. Acting collaboratively, Commonwealth, state and territory governments represent a powerful agent for change.

The partnership approach provided by the National Electronic Decision Support Taskforce has enabled considerable progress to be made in a short timeframe. The continuation of this work through the establishment of an interim National Implementation Unit should help ensure the continuation of this necessary collaboration.

The interim National Implementation Unit would be responsible for delivering outputs identified in the National Action Plan. It is envisaged that working groups would be formed to undertake specific projects and the unit would determine appropriate membership for these working groups.

The interim National Implementation Unit would also continue to advise on policy issues that arise from the next phase of national activity.

Funding is required for the following components.

**Governance.** This includes the costs associated with running the interim National Implementation Unit and its secretariat to coordinate and manage the development activity and oversee the implementation of the National Action Plan (table 10.1).

**Development costs.** These include the development of key deliverables, such as the development of standards, a research and investment plan, an evaluation methodology and communications materials, etc. (table 10.2).

**Implementation costs.** These include the costs of implementing aspects of the National Action Plan, such as the Accreditation Agency (table 10.3).

Establishment of the governance arrangements would be one of the first activities undertaken and the costs are reasonably well defined. Table 10.1 provides costings for the governance arrangements based on existing structures.

**TABLE 10.1 Indicative costs associated with interim governance arrangements**

		2003–04	2004–05
<b>Governance</b>	National Implementation Unit (travel and sitting fees)	\$25,000	\$40,000
	Working groups	\$10,000	\$20,000
	Secretariat and other administrative costs	\$185,000	\$240,000
<b>Total</b>		<b>\$220,000</b>	<b>\$300,000</b>

The National Action Plan identifies a number of areas of development work. Table 10.2 provides indicative costings for the development of these key deliverables.

**TABLE 10.2 Indicative costs associated with development work in the National Action Plan**

Development costs		2003–04	2004–05
<b>Research, development and best practice</b>	1 National research and development plan.	\$50,000	\$20,000
	2 Program to encourage collaborative projects.	\$20,000	\$20,000
	3 Criteria for assessing whether clinical knowledge can be converted.	\$80,000	
	4 Best practice standards in the development of electronic decision support systems.	\$50,000	\$50,000
<b>Safety and quality of systems</b>	1 Standards and procedures for having clinical knowledge bases accredited.	\$80,000	\$150,000
<b>Standards framework</b>		\$50,000	\$150,000
<b>Evaluation culture</b>	1 Evaluation methodology.	60,000	\$120,000
<b>Encourage uptake</b>	1 Identify current usage and barriers to uptake	\$150,000	\$80,000
	2 Review impact of EDSS on work processes	\$100,000	\$80,000
	3 Promote EDSS in academic courses	\$15,000	\$10,000
	4 National Communications Strategy	\$200,000	\$100,000
<b>National coordination and governance arrangements</b>	1 Clearinghouse	\$80,000	\$100,000
	2 Annual forum	\$80,000	\$80,000
<b>Total</b>		<b>\$915,000</b>	<b>\$1,060,000</b>

From the beginning of second year, implementation costs would begin to be incurred. They are summarised in table 10.3.

**TABLE 10.3 Indicative implementation costs of the National Action Plan**

Implementation costs		2003–04	2004–05
<b>Safety and quality</b>	1 Form an accreditation agency		\$50,000
	2 Establish a register of approved knowledge bases		\$15,000
<b>Standards framework</b>	1 Implement the standards framework		\$100,000
<b>Evaluation culture</b>	1 Mandate the use of the evaluation methodology		\$40,000
<b>Total</b>			<b>\$205,000</b>

## Summary

The overall indicative costs for implementing the National Action Plan over two years (ie from July 2003 until June 2005) are estimated at \$2.7 million, of which \$1.135 is estimated for the 2003–04 financial year and \$1.565 is estimated for the 2004–05 financial year. Clearly, the cost estimates are sensitive to assumptions made and these can be further refined as detailed planning is undertaken.

This report does not attempt to quantify the savings that could be realised in the health sector resulting from the greater use of electronic decision support systems. However, it is clear that significant savings could be achieved just through the reduction of medication errors. If, for example, the inappropriate use of medicines in public hospitals is reduced by only one per cent through the use of electronic decision support systems, then there would be expected savings of around \$3.8 million per annum (AIHW 2002).

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# Part C

## Appendices









# **Appendix A**

## **Electronic Decision Support Activities in different healthcare settings in Australia**

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University of NSW  
November 2002**

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# LIST OF ABBREVIATIONS

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EBP	Evidence-Based Practice
MSIA	Medical Software Industry Association
NHIMAC	National Health Information Management Advisory Council
NICS	National Institute of Clinical Studies
ADE	Adverse Drug Event
E-PDS	Electronic Prescription Decision Support
PoCCS	Point of Care Clinical System
POE	Physician Order Entry
CIAP	Clinical Information Access Project
NHMRC	National Health and Medical Research Council
BMMS	Better Medication Management System
ARC	Australian Research Council
IT	Information Technology

# EXECUTIVE SUMMARY

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## Background

Electronic decision support systems are designed to support healthcare workers in the normal course of their duties. They assist with decision-making tasks where humans are challenged because of the complexity of the decision, the amount of knowledge needed to be mastered, or because the pressure of work increases the risk that errors will occur. Electronic decision support systems have been hailed for their potential to reduce medical errors and increase healthcare efficiency. Evidence-based practice has been promoted as a means of improving clinical outcomes and the use of electronic decision support systems to facilitate evidence-based practice promises to substantially improve healthcare quality.

## Objectives

Objectives of this report are to:

- detail the current status of electronic decision support implementation world-wide, identifying significant decision support systems in operation, the audience for those systems, information on implementation difficulties and rates of uptake
- present an overview of the evidence of the effectiveness of electronic decision support systems in improving clinical outcomes
- prepare an inventory of large-scale and/or significant electronic decision support activities in Australia
- identify factors that are critical to ensuring successful development of electronic decision support systems on a national basis and barriers to the successful implementation of such systems that need to be addressed in the Australian context, and
- describe the likely benefits of a more coordinated approach to the development of electronic decision support systems for clinicians and other key stakeholders.

## Methods

A literature review of the current status of electronic decision support implementation world-wide and in Australia was conducted. An inventory of existing electronic decision support systems projects in Australia was undertaken. We specifically only included systems that are implemented and in routine use by clinicians, have been used within the last 5 years, provide clinical rather than management support, and are not embedded into medical instruments.

Our literature search yielded 55 papers that matched our inclusion criteria. We interviewed 127 individuals representing a broad range of public and private healthcare organisations, professional bodies, the academic sector and medical software industry. We have been able to identify 35 significant electronic decision support systems in routine use in Australia.

## Results and recommendations

### Evaluation

About one quarter of the projects in the inventory attempted to evaluate their system in any rigorous or comprehensive manner. Most concentrated on user acceptability of the electronic decision support systems, rather than attempting to measure improvements to clinical processes or outcomes. There was widespread variation in the evaluation methods chosen, making comparison of the effectiveness of different systems very difficult. There appears to be no consistent attempt to re-use or extend standard evaluation methods. Consequently, the bulk of the investment in electronic decision support systems in Australia remains largely unevaluated, and it is not possible to make clear statements about costs and benefits in the absence of evaluation data.

Some projects indicated that evaluation did not occur because funding was not made available for this activity, indicating that evaluation is not a priority amongst funding bodies. Evaluation requires specialised skills, both for formative and summative assessments, and it is also likely that there is a significant skills shortage in this area.

### Likely benefits of a national coordinated approach to the development of electronic decision support systems

Co-ordinating the approach to evaluation at a national level could significantly improve the current situation:



- A national body could assist in developing a set of benchmarks, or at least common methodologies, that permit comparison of the impact of systems in the clinical environment.
- A national approach could also encourage the inclusion of evaluation as a core component of any electronic decision support activity.

## Recommendations

1. That evaluation be made a required component of any government funded electronic decision support program, whether for research or operational systems, and that sufficient funds be made available to adequately resource such evaluation.
2. That evaluation guidelines be developed to ensure that when evaluations occur, they use rigorous and validated methods, and that their results are robust and permit across project comparisons. Adherence to these guidelines may be a condition for government-funded projects.
3. A national clearinghouse be set up to collect evaluation reports and enhance the dissemination of data about the efficiency and effectiveness of electronic decision support projects.

## Quality and safety of system engineering

Adoption of software engineering standards is best practice in many sectors of the IT industry and in the medical devices sector, but this is not reflected in the electronic decision support systems in our survey. Amongst the systems in the inventory, only two reported the use of quality processes or quality testing to ensure that the systems performed correctly. Further, there was a lack of awareness of what such process standards might be. Consequently there appears to be a substantial gap in quality process in electronic decision support projects in Australia, raising the risk either that projects will fail because they are poorly managed, or the systems will perform unsafely or unreliably when fielded in clinical settings.

## Likely benefits of a national coordinated approach

The process of developing guidelines for electronic decision support system development and testing is likely to be complex and technically demanding, and is unlikely to occur at anything other than a national level. Further, in line with the medical device industry, if certification of electronic decision support systems compliance with standards is contemplated, this too is only likely to occur at a national level.

## Recommendations

4. That government-funded projects be required to adopt best-practice standards in the development of electronic decision support systems.
5. That research be funded to report on the available standards for safety engineering of electronic decision support systems, noting that standards may vary between the different levels of decision support offered by a system, and the stage in a system's development from research prototype to operational system.
6. That consideration be given to the need for educational activities to inform government and industry of the critical importance of quality and safety standards in the design and ongoing support of electronic decision support systems.
7. That consideration be given to adopting an accreditation system for operational systems, checking for compliance with standards of best-practice in system engineering and ongoing maintenance.

## Co-ordination of investments in electronic decision support systems

The projects contained in the inventory collectively represent an investment of over \$230 million. There are many projects identified in the inventory, but little co-ordination between most of them. Few projects were targeted at national priority areas for health. This suggests that there may be opportunities lost for sharing of experiences, or pooling of funds amongst projects with similar aims. It also suggests that there is no formal process of priority setting in the electronic decision support field, despite the large investment occurring. Some notable positive examples of inter-State co-operation at a government level were identified. The Clinical Information Access Project (CIAP) from New South Wales Health has influenced the development of similar on-line evidence access systems in the other States. Two states, Victoria and Queensland, subsequently joined New South Wales in contractual agreements achieving significant economies of scale in purchasing clinical databases. A national Forum meets annually to share experiences with online evidence systems.

## Likely benefits of a national coordinated approach

While many electronic decision support projects will naturally be sponsored by State-based organisations, or industry, a large proportion of current funds are derived Federally. If these funds were co-ordinated, there appears to be a substantial opportunity to prevent duplication of effort, sharing of experience and expertise, and refocussing on core priority areas.

## Recommendations

8. National priorities in electronic decision support research and investment be set, with reference both to national health priorities, as well as the need to develop the research and skill base in electronic decision support to service the large demand for such systems.
9. A national mechanism be developed to support co-operation between electronic decision support project teams. The aims would be to assist individual funding agencies to find partners in their electronic decision support projects and to ensure new projects build on past projects by identifying similar previous projects. The electronic decision support clearinghouse may be the basis of such a mechanism.
10. Consideration be given to developing mechanisms for large scale projects like the Better Medication Management System to, where possible, partner with smaller projects which may be able to re-use infrastructure, assist in skill development, and exploit the expertise concentrated in the larger projects.
11. An annual electronic decision support Forum or Conference be sponsored to encourage interaction amongst stakeholders, share experiences, and contribute to the building of networks between government, academia and industry.

## Role of industry

Government is the driver of the Australian electronic decision support sector. Over two thirds of projects were funded predominantly by government. A small number of projects accounted for the bulk of the investment, and typically these are funded Federally, for example the Better Medication Management System. Amongst the projects reported in the inventory as being ‘in progress’, 14 were government funded and four were industry supported.

Industry routinely reports that, on the occasions when it is asked to undertake electronic decision support projects, it does not have spare capacity to undertake such projects, because of the intermittent nature of funding and the difficulty in retaining staff during lean times. The fragmented nature of the medical software industry also means that there is little capacity to undertake research and development in-house. Yet electronic decision support systems at Type Two and upwards require the use of knowledge-based technologies, which are still not widespread in the IT industry and would require some research and development capacity for many software houses to be in a position to develop them.

### **Likely benefits of a national coordinated approach**

The healthcare IT industry is still relatively fragmented and many software houses are small. Encouraging industry to collaborate internally, as well as with academic and government-based agencies, may result in a more co-ordinated and cost-effective approach to the development of electronic decision support systems, with many players sharing the risk and resources needed to undertake research and development. Such activities may also assist in fostering a new electronic decision support systems industry in Australia that is internationally competitive.

### **Recommendations**

12. Consideration be given to a program modelled upon the Australian Research Council's linkage program, which encourages collaborative projects between academia and industry, and results in the transfer of new technologies into operational settings, as well as contributes to enhancing the capacity of industry to undertake research and development.

### **Capacity development and electronic decision support research**

As already indicated, the projects contained in the inventory collectively represent a considerable investment of over \$230 million. Paradoxically the electronic decision support community in Australia seems small, as indeed is the wider health informatics community from which it is drawn. Few projects indicated that the results of their projects would be written up in the literature, and the failure for most to address evaluation indicates a lack of research culture. As a result few robust lessons can be drawn from most projects. There appears to be a large gap between the increasing demand for the design, evaluation and implementation of electronic decision support systems and the available national skill base to meet this demand. Finally, despite the fact that much of the variation in uptake of information technology in healthcare can be attributed to socio-technical issues such as organisational culture, little attention to such issues are revealed in our project inventory.

### **Likely benefits of a national coordinated approach**

The small pool of experienced health IT and health informatics professionals available suggests that a State-based approach is unlikely to be sustainable, and that capacity building is a national priority. The creation of a trained and experienced pool of such individuals nationally should result in a reduction in the risk associated with implementing electronic decision support projects, an improvement in the quality and impact of such systems when deployed, and may assist in fostering a new industry in Australia that is internationally competitive.

## Recommendations

13. The development of national capacity in electronic decision support be supported by the provision of specific funds to support research in the design and evaluation of electronic decision support systems in clinical settings, for example by identifying specific panels within the National Health and Medical Research Council, the Australian Research Council or the National Health Information Management Advisory Council. As part of that strategy it may be appropriate to identify infrastructure funds over several years, to support the development of one, or several, centres of excellence in electronic decision support research.
14. The development of national capacity in electronic decision support be supported by the provision of specific funds to support education and professional development at a postgraduate level. This could come via the creation of local, international and industry training fellowships. It could also be supported by provision of seed funds to encourage the development of courses, which would presumably be self-funding once past their start-up phase.
15. Consideration be given to set up a register of professional experts in key areas who may be available to provide consultancy regarding electronic decision support systems development and evaluation. This could be incorporated into the clearinghouse database.
16. Encourage research into the broad range of issues needed to understand how systems are to be integrated successfully into healthcare settings and to maximise the impact of such technologies, with encouragement of socio-technical studies.

# 1 INTRODUCTION

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Electronic decision support systems are designed to support healthcare workers in the normal course of their duties. They assist with decision-making tasks where humans are challenged because of the complexity of the decision, the amount of knowledge needed to be mastered, or because the pressure of work increases the risk that errors will occur. Electronic decision support systems have been hailed for their potential to reduce medical errors and increase healthcare efficiency. Evidence-based practice has been promoted as a means of improving clinical outcomes and the use of electronic decision support systems to facilitate evidence-based practice promises to substantially improve healthcare quality.

There are many different types of clinical task to which an electronic decision support system can be applied:

- *Generating alerts and reminders.* In real-time situations, an electronic decision support system attached to a monitor can warn of changes in a patient's condition. In less acute circumstances, it might scan laboratory test results or drug orders and send reminders or warnings through an e-mail system.
- *Diagnostic assistance.* When a patient's case is complex, rare, or the person making the diagnosis is simply inexperienced, an electronic decision support system can help come up with likely diagnoses based on patient data.
- *Therapy critiquing and planning.* Systems can either look for inconsistencies, errors and omissions in an existing treatment plan, or can be used to formulate a treatment based upon a patient's specific condition and accepted treatment guidelines.
- *Agents for information retrieval.* Software 'agents' can be sent to search for and retrieve information, for example on the Internet, that is considered relevant to a particular problem. The agent may contain knowledge about its user's preferences and needs, and may also need to have medical knowledge to be able to assess the importance and utility of what it finds.
- *Image recognition and interpretation.* Many medical images can now be automatically interpreted, from X-rays through to more complex images like angiograms, computed tomography and magnetic resonance imaging scans. This is of value in mass-screenings, for example, when the system can flag potentially abnormal images for subsequent detailed human attention.

Electronic decision support systems that generate conclusions from patient data typically utilise knowledge-based technologies such as rule-based expert systems, Bayesian belief networks or neural networks. Comprehensive lists of world-wide

available medical knowledge-based systems can be found on <http://www.coiera.com/ailist/list.html>, <http://www.openclinical.org/aisdss.html> and <http://medexpert.imc.akh-wien.ac.at/>.

Electronic decision support systems have been hailed for their potential to reduce medical errors and increase healthcare efficiency (Sim et al. 2001). Evidence-based practice has been promoted as a means of improving clinical outcomes and the use of electronic decision support systems to facilitate evidence-based practice promises to substantially improve healthcare quality (Weekley et al. 2000; West, 2000).

## 1.1 National Electronic Decision Support Taskforce

Even though there has been substantial development work in electronic decision support systems, it appears that much of it has been fragmented and uncoordinated, leading to problems of accessibility, scalability, duplication and lack of integration with existing systems. The Taskforce is examining whether, for electronic decision support systems to make a difference to the quality of healthcare, that there is a place for a nationally coordinated approach to the development of such systems and a national governance structure to provide direction and coordination on electronic decision support.

The Taskforce was formally established in May 2002. The objectives of the Taskforce are to:

- identify, at a national level, the work program and national governance arrangements required to ensure the development of sustainable, nationally integrated electronic decision support systems
- gain wide support for a nationally coordinated approach to the development of electronic decision support systems from key stakeholders, and
- recommend a way ahead to Australian Health Ministers in sufficient detail to enable them to make decisions and commit resources.

The Taskforce has defined electronic decision support as: “Access to knowledge stored electronically to aid patients, carers, and service providers in making decisions on healthcare”.

The key deliverables of the Taskforce are:

- a description of the governance structure that needs to be put in place to ensure a national coordinated approach to the development of electronic decision support systems to aid clinical decision making at the point of care



- a report that provides an inventory of large-scale electronic decision support activities and expenditure in Australia focussing on information that is relevant to the objectives of the Taskforce
- a review of the evidence about the effectiveness of electronic decision support systems in improving clinical outcomes, the benefits of a more coordinated approach and the barriers to the successful development of electronic decision support systems
- a statement about the needs of the health information industry and the needs of clinicians as they relate to electronic decision support systems and the uptake of such systems
- a description of the additional work program that needs to be undertaken and the governance structure that needs to be put in place to ensure the development of sustainable, nationally integrated electronic decision support systems, and
- a report to Australian Health Ministers recommending a way ahead, including on governance arrangements, priorities, timetables and costings.

## 1.2 Objectives of the report

The objectives of this report are to:

- present an overview the evidence of the effectiveness of electronic decision support systems in improving clinical outcomes
- detail the current status of electronic decision support implementation world-wide, identifying significant decision support systems in operation, the audience for those systems, information on implementation difficulties and rates of uptake
- prepare an inventory of large-scale and/or significant electronic decision support activities in Australia
- identify factors that are critical to ensuring successful development of electronic decision support systems on a national basis and barriers to the successful implementation of such systems that need to be addressed in the Australian context, and
- describe the likely benefits of more coordinated approach to the development of electronic decision support systems for clinicians and other key stakeholders.

The report is divided into five parts:

- A review of the benefits of electronic decision support systems based on a survey of the international literature.



- A selective international literature review of clinically evaluated electronic decision support systems since 1998.
- An inventory of clinically fielded electronic decision support systems in Australia since 1998.
- A summary of the benefits of, and factors critical to, the success of electronic decision support systems.
- A summary of the evidence in this report and a set of recommendations to the Taskforce.

## 2 ELECTRONIC DECISION SUPPORT: EVIDENCE OF THE CLINICAL BENEFITS OF ELECTRONIC DECISION SUPPORT SYSTEMS

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Many potential benefits from electronic decision support systems have been widely reported in the literature (Johnson & Feldman, 1995; Evans, 1996). The claims made fall into 3 broad categories:

- 1 Improved patient safety** eg through reduced medication errors and adverse events and improved medication and test ordering.
- 2 Improved quality of care** eg by increasing clinicians' available time for direct patient care, increased application of clinical pathways and guidelines, facilitating the use of up-to-date medical evidence, improved clinical documentation and patient satisfaction.
- 3 Improved efficiency in healthcare delivery** eg by reducing costs through faster order processing, reductions in test duplication, decreased adverse events, and changed patterns of drug prescribing favouring cheaper but equally effective generic brands.

The following provides a review of some of the key research studies which provide evidence of the effectiveness of electronic decision support systems in improving the safety, quality and efficiency of healthcare.

### 2.1 Improvement in patient safety

#### Reduction in medication errors and adverse drug events

The interest in electronic prescribing systems has been generated by growing evidence of their effectiveness (Bates et al. 1998; Bates et al. 1999) in reducing medication errors, one of the most significant causes of iatrogenic injury, death and costs in hospitals (Institute of Medicine, 2000; Thomas et al. 1999). In the United States it is estimated that over 770,000 people are injured or die each year in hospitals as a result of adverse drug events (Kaushal & Bates, 2001). The greatest proportion (56 per cent) of preventable adverse drug events occur at the drug ordering stage, 34 per cent at administration, 6 per cent at transcribing and 4 per cent at dispensing (Bates et al. 1995). Errors occurring at the earlier stages eg drug order, are more likely to be

intercepted (48 per cent) compared to those occurring at the administration stage (0 per cent). The automation of clinical orders improves standardisation and reduces problems such as the legibility of orders. Thus physician order entry (POE) is particularly useful in improving accuracy of drug ordering, the stage most likely to have a significant impact upon reducing these type of adverse events (Massaro et al. 1989; Ash et al. 1998). The most convincing evidence that electronic prescription decision support (E-PDS) systems significantly reduce medication errors and adverse drug events derives from two seminal studies undertaken at the Brigham and Women's Hospital in Boston, Massachusetts (Bates et al. 1998; Bates et al. 1999). The E-PDS system was developed specifically by the hospital and contained clinical decision support such as allergy alerts and suggested drug doses.

One of the strengths of these studies is the examination of specific classes of medication errors, fostering an understanding of the type of errors that E-PDS systems are most likely to improve upon.

The first study (Bates et al. 1998) used a pre/post E-PDS system implementation study design and demonstrated a 55 per cent reduction in potential adverse drug events (ie errors which did not result in injury but had the potential to do so) following system implementation. The rate of adverse drug events fell from 10.7/1000 patient days to 4.9 per 1000 patient days. Within this category a reduction of 84 per cent in the rate of non-intercepted potential adverse drug events (ie those potential adverse drug events which were not detected and by chance failed to result in injury despite being undetected) from 6.0 to 1.0 per 1000 patient days was found. A decrease in preventable adverse drug events (ie errors which resulted in injury) of 17 per cent was found but this was not a statistically significant reduction compared to pre system implementation.

The second study (Bates et al. 1999) used a time series design and examined changes in medication errors over three time periods (5 months, 2.5 years and 4 years) and found decreases in several categories of medication errors. Overall, there was an 81 per cent decrease in medication errors pre and post E-PDS system implementation, and an 86 per cent reduction in potential adverse drug events from time of pre-implementation to 4 years post-implementation. These results excluded drug incidents where patients missed doses, for example, because the medication was not available at the time for administration.

Unexpectedly, in the initial two follow up periods, at five months and at 2.5 years post-system implementation, the number of life-threatening intercepted potential adverse drug events increased substantially from 11 per cent pre-implementation to 95 per cent in followup period 1, to 93 per cent in followup period 2. The majority of these related to orders regarding potassium chloride. The E-PDS system made it easy to order large doses of intravenous potassium without specifying that it be

given in divided doses. Once changes were made to the order screen for this drug, the number of life-threatening intercepted potential adverse events fell to zero in followup period 3.

The number of missed-dose errors also substantially rose during the study. The reason for this increase was not easily identified and was deemed to probably be multi-factorial and related to changes occurring within the hospital. While this type of error rarely causes significant harm, the researchers estimated that each missed dose error resulted in about 15 minutes of extra work and thus constituted a high cost.

While Bates and colleagues studies show that E-PDS systems significantly reduce serious medication errors, the studies also clearly demonstrate the potential negative impact drug order entry systems can have, and the importance of monitoring the impact over time to guard against these occurrences. For example, the significant increase in potential adverse events due to potassium chloride orders continued for over two years following system implementation.

In a further report, Birkmeyer et al (2000) used data from existing studies of the rates of potential preventable adverse drug events and the effectiveness of E-PDS systems to reduce those rates (Bates et al. 1998; Bates et al. 1999), to estimate the number of potential adverse drug events which would be prevented if these systems were implemented nationwide in the United States. They calculated that E-PDS implementation would prevent approximately 522,000 potential preventable adverse drug events each year. They further extrapolated and stated that:

“...if only 0.1 per cent of such errors were fatal, over 500 deaths would be avoided by physician order entry every year.” (Birkmeyer et al. 2000, p.3)

However given the paucity of data regarding the effect of E-PDS systems on mortality rates the researchers concluded that large multi-centre trials would be required to better estimate the impact of E-PDS systems on mortality rates.

In a systematic review of the impact of decision-support systems on the practice of doctors and patient outcomes Hunt et al (1996) identified 68 studies, 15 of which involved decision support systems to assist dosing of potentially toxic drugs. Of these, 8 focused on dosing of intravenous drugs and 6 found improvements following the use of the decision support systems. Four of the 8 studies examined the impact on patient outcomes, yet only 1 found a significant benefit (Mungall, Anbe, Forrester P, 1994).

The remaining 7 studies examined the use of decision support systems for warfarin dosing and the results, in terms of improvements, were conflicting with some studies reporting benefits and others showing no effect. In conclusion the authors stated that the consistent pattern of evidence suggests that,

“...intravenously administered medications can be titrated more effectively using a clinical decision support system than without one if the pharmacokinetics are well understood.” (p.1343)

However the same conclusion could not be made for warfarin where results were inconsistent.

In a further United States teaching hospital study, drug alerts were written to specifically target potential adverse drug events. These alerts were printed and reviewed by pharmacists and then concerns referred to prescribing doctors when necessary. Of the 1116 drug alerts studied, 53 per cent were true positives producing a rate of 64 potential adverse drug events per 1000 patient admissions. In 44 per cent of the true positives where a change in drug management was required, doctors stated that they were unaware of the potential clinical situation leading to the alert (Raschke et al. 1998). This provides further evidence of the benefit of electronic decision support systems to reduce errors in the drug ordering process.

A United States ambulatory setting study adopted a similar approach. Pharmacists evaluated medication prescriptions filled by 2.3 million people 65 years and older by using automated alerts which identified potentially dangerous drug doses or combinations. In one year over 43,000 alerts were issued among 23,697 people. For 56 per cent of alerts the physician was able to be contacted and drug management discussed. In 15 per cent of instances when the physician was contacted the alerts resulted in an immediate change in drug management and in a further 9 per cent there was agreement to review management at the next patient visit (Monane et al. 1998).

## Enhancing prescribing behaviour

Electronic prescription decision support systems have the potential to not only reduce medications errors but also to change medication prescribing patterns resulting in more cost-effective drug selection. Teich et al (2000) reported the impact of computerised order entry on the drug ordering behaviour of clinicians over a three-year period. They examined four specific drug decision support interventions embedded in the electronic prescription decision support system. These were:

- a prompt to use a cheaper generic drug when a more expensive drug was initially ordered
- presentation of a list of suggested drug doses for each medication ordered
- a highlighted recommended frequency of dose for specific intravenous drugs, and
- a prompt to suggest the order of a blood thinning drug for patients prescribed bed rest.

Data relating to each of the four drug ordering practices prior to the implementation of the order entry system were collected and then compared with drug ordering patterns immediately and at 1, 2 and 3 years post-system implementation. For all drug ordering interventions an immediate positive impact was found with greater compliance with the recommended drug orders. Compliance with the generic drug choice changed from around 14 per cent pre-implementation to over 80 per cent 2 months post system implementation and to 97 per cent compliance at 1 and 2 year followup. The proportion of drug orders which exceeded the recommended maximum dose dropped from 2 per cent in the pre-implementation period to less than 0.3 per cent 2 years post-implementation.

Change in the frequency of dose to reflect the recommended frequency occurred, with 6 per cent compliance pre-implementation moving to 94 per cent compliance at 1, 2 and 3 year followup. Orders for blood thinning drugs for patients prescribed bed rest increased from 24 per cent pre-implementation to 54 per cent at 2 year follow up. This study thus provides some evidence of the capacity of electronic prescribing systems to influence aspects of the medication ordering behaviour of clinicians.

Overall, there is now a body of studies which provides some good evidence of the effectiveness of electronic decision support systems, specifically computerised medication order entry systems, to increase the safety of patients by reducing errors, adverse events and by increasing the proportion of appropriate and safe prescribing decisions (Classen et al. 1997; Armstrong & Denemark, 1998; Nolan et al. 1999; Improving Medication Safety: Second National Report on Patient Safety. Australian Council for Safety and Quality in Health Care, July 2002).

## 2.2 Improved quality of care

Multiple measures have been used to attempt to assess the impact of electronic decision support systems on quality of care. Most have examined changes in work practices with the expectation that improvements in patient outcomes will follow. Examples of process measures examined include increased compliance with practice guidelines or clinical pathways (Dennis et al. 1993; Overhage et al. 1996; Lobach & Hammond, 1997; Birkmeyer et al. 2000); increases in the proportion of time available for direct patient care (Brown et al. 1995; Shu et al. 2001); greater use of evidence to support clinical decisions (Friedman et al. 1999; Kushniruk et al. 2001; Westbrook & Gosling, 2001); and improved clinical documentation (Dennis et al. 1993; Ammenwerth et al. 2001; Nahm & Poston, 2002).

Direct measurement of clinical or health outcomes is rare and this is largely attributable to the difficulty of undertaking such studies. One of the few studies to

have included a direct measure of improved health was undertaken in a general medical clinic where clinicians were randomised to a reminder system over a two year period (McDonald et al. 1984). Patients eligible for a flu or pneumococcal vaccine and who attended one of the clinicians who received the reminder system, experienced significantly fewer winter hospitalizations and emergency room visits than patients in the control group. However no significant improvement in outcomes was found for patients who received other forms of preventive care during the trial.

## Improved compliance with clinical pathways and guidelines

Order entry and results reporting systems with embedded decision support can increase compliance with recommended clinical pathways and guidelines and have been shown to reduce rates of inappropriate diagnostic tests (Harpole et al. 1997).

A randomised controlled trial assessed the impact of decision support information (evidence regarding the effectiveness of a 5 day course of antibiotics versus a 10 day course) on paediatricians' choice of length of antibiotic course (Christakis et al. 2001). Those clinicians randomised to receive the decision support responded positively with an increase in the proportion of antibiotic prescriptions for less than 10 days duration, from 51 per cent pre-intervention to 70 per cent post-intervention. The paediatricians in the control group also increased their use of the recommended dose, but by a smaller proportion. This change was attributed to a diffusion of the evidence from the members of the control group who were working in the same clinic. In a similar randomised trial design (Shojania et al. 1998) some clinicians were exposed to vancomycin prescribing guidelines when they attempted to order this antibiotic. This group of clinicians reduced their use of vancomycin by 30 per cent, and when prescribed, a significantly shorter duration was given, compared to the control group.

Hunt et al.'s (1998) systematic review of electronic decision support systems reported that of 19 systems (18 in primary care) aimed at providing preventive care reminders, 14 (74 per cent) reported benefits to the processes of care, thus concluding that preventive care reminder systems are a reasonably effective intervention in an ambulatory setting.

Alerts have been found to increase the percentage of corollary orders made (ie orders for laboratory tests to check for adverse reactions as a result of a medication correctly ordered, for example a check of electrolytes when ordering potassium for a patient) (Overhage et al. 1997). In addition alerts were demonstrated to result in faster treatment by highlighting patients whose medication needed review. For example, Rind et al (1994) using a time series study design assessed the impact of an alert system notifying doctors of patients experiencing rising creatinine levels and receiving nephrotoxic or renally excreted medications who therefore required an adjustment



to their medications in order to prevent renal damage. They found that the use of the alerts was associated with a significantly faster average response to change patients' medications. While the absolute risk of renal impairment in these patients was low, the alert system further significantly reduced this by 55 per cent, with the patients treated during the alert phase having a relative risk of serious renal impairment of 0.45 (95 per cent confidence interval 0.22 to 0.94) compared to the control period when alerts were not in place.

However other studies have found alerts to be of little effect in changing clinician behaviour. One example is a study of the impact of reminders printed on daily hospital ward round reports to prompt hospital physicians about preventive care for patients. The alerts were found to have little impact on physicians' implementation of preventative care. This occurred despite these clinicians' reporting that they believed acute hospitalisation provided an appropriate opportunity for reviewing and implementing preventive care (Overhage et al. 1996).

## Time released for patient care

One potential benefit of the implementation of order entry systems is that they increase the efficiency of administrative tasks and thereby allow clinicians to spend more time in direct patient care. This indicator has been measured using work sampling methods. Shu et al (2001) undertook a study of the impact of Patient Order Entry (POE) on time spent ordering, and available time for other tasks at Massachusetts General Hospital in the United States. They applied a modified version of work sampling using a random reminder method. Forty-three physicians pre-implementation and 29 post-implementation carried pagers which were set to go off 1.8 times per hour. On each of these occasions physicians recorded their current activities in a logbook using predefined codes. Post-implementation interns spent 3 per cent more of their time with patients (from 13–16 per cent), 6 per cent more of their time alone (32 per cent versus 38 per cent) and less time with other physicians (47 per cent versus 41 per cent) (Shu et al. 2001).

Tierney et al (1993) conducted a time and motion study to determine time spent by clinicians in the order entry process. Use of the POE resulted in increased time writing orders compared to paper orders (59 minutes versus 26 minutes). Clinicians randomised to the POE however spent 6 minutes per day less in recording routine patient record data. Admitting medication orders on average were filled 63 minutes faster and 34 minutes faster for daily drug orders when the POE was used compared to drugs ordered without the POE. These results highlight that single indicators of improved efficiency are of limited use in understanding the overall impact of electronic decision support systems on an organisation. Thus the extent to which such systems release clinicians from administrative tasks allowing them to spend a greater proportion of their time in patient care will vary depending upon multiple factors such as type of system used, professional group, tasks to be undertaken, and experience with the system.



## Improved access and use of online evidence

Provision of access to online evidence via a point-of-care system may occur as either an 'active request' for information by the clinician (eg made a request to view an online clinical guideline) or alternatively evidence may be delivered to the clinician in response to an event, such as making an order selection. Most decision support systems provide reactive alerts and assessments of their impact have been described in earlier sections.

The Clinical Information Access Program (CIAP), implemented in NSW, is a 24 hour, online, point of care evidence retrieval system. Evaluation of the use and impact of the CIAP has demonstrated significant use of evidence by clinical staff to support direct patient care, and examples of specific individual improvements in patient outcomes as a result of application of the evidence retrieved (Westbrook & Gosling, 2001; Gosling & Westbrook, 2002). In a survey of 5,500 clinicians in NSW who used the CIAP, 88 per cent reported that they thought CIAP had the potential to improve patient care and 41 per cent reported direct experience of this. Patterns of use of this system by 55,000 clinicians across the state demonstrated that evidence retrieval is principally related to direct patient care, but good use is also made of the system to support continuing education activities and research (Westbrook & Gosling, 2001).

## Data feedback to change clinical practice patterns

Computerisation of aspects of care via the implementation of order entry and clinical documentation systems, presents an opportunity to more easily review clinical practice patterns. For example, data regarding patterns of medications and tests ordered for specific patient groups provides an important evidence base for reviewing current practice and for discussing variations in practice. Previous studies have demonstrated that feedback to clinicians of data regarding clinical practice has a positive impact on care patterns (Westbrook & Goodwin, 1990; Westbrook, 1991) and cost of care (Buck & White, 1974; Beilby & Silagy, 1997).

Development of specific decision support systems for reviewing clinical practice patterns against guidelines has been attempted with no reports of its outcomes (Balas et al. 1994). The feedback of clinical practice and evaluation data to groups within the organisation is an important element in the transforming process of an organisation. The extent to which such feedback loops generate effective change is itself a measure of the performance of the organisation (Eoyang & Berkas, 1999). The potential strength of electronic decision support systems to generate new data feedback loops is rarely discussed in the literature and appears to be an advantage yet to be well exploited.

## Improvements in patient satisfaction

While improvement in patient satisfaction as a result of the adoption of electronic decision support systems has been advanced as a potential benefit, there is little substantiating evidence. Studies of patients' views of electronic decision support systems have focused on systems used in general practice. For example, Legler and Oates (1993) found patients' ratings of general practitioners' use of computers to enter patient data during a consultation compared to paper and pen entry were not significantly different. However Greatbatch et al (2001) found that such systems resulted in subtle changes to the structure and process of discussions between patients and their general practitioners.

While patient satisfaction is an important indicator, it is multi-dimensional and fraught with measurement difficulties (Westbrook, 1993). Improvements in the quality, safety and efficiency of health care resulting from electronic decision support system implementation will likely influence patients' satisfaction with care. However until comprehensive electronic decision support systems are in place, significant improvements in patient satisfaction are unlikely to occur. Research on appropriate measurement tools is required and a long-term perspective is needed.

## 2.3 Improved efficiency of healthcare delivery processes

Studies relating to the impact of electronic decision support systems on the efficiency of health care delivery have focused on:

- **reductions in costs** due to fewer medication errors and adverse drug events; increased efficiency in the execution of patient care, particularly in relation to tests and drug orders; and increased use of generic drug brands, and
- **reductions in physician time** spent on administrative tasks releasing time to be spent on patient care.

Less attention has been paid to measuring improved efficiency due to review of clinical practice, the greater use of evidence and clinical pathways, or greater organisational responsiveness to change (Mason et al. 2001).

Several estimates of the money saved as a result of computerised physician order entry (POE) systems have been made. At Brigham and Women's hospital in the United States order entry systems are estimated to save about \$5–10 million per year largely due to the increased use of less expensive tests and drugs. In the United States one adverse drug event is estimated to add an average of \$2000–\$6000 to a

patient admission and thus in total are estimated to cost over \$2 billion each year in United States hospitals alone (Raschke et al. 1998). Thus order entry systems demonstrated to reduce adverse events should also result in significantly lowering costs.

In a randomized controlled trial, Tierney et al (1993) demonstrated that patients treated by physicians who used a POE containing decision support information, which included costs of specific drugs and diagnostic tests, had less expensive hospital stays than did patients treated by clinicians without access to the POE system. Extrapolation of the cost savings due to reduced costs per admission were in the order of \$3 million for the teaching hospital. However, no adjustments were made to account for fixed or marginal costs.

Other studies have indicated that POE increase the amount of time clinicians spend on the ordering process (Overhage et al. 2001; Shu et al. 2001). In a pre-post POE system implementation study clinicians were found to spend a greater proportion of their time writing orders (from 2 per cent pre-implementation to 9 per cent post-implementation). However there was a 2 per cent saving in time related to other activities associated with the ordering process. Thus in total there was a net increase of only 5 per cent in the proportion of time physicians spent on the ordering process (Shu et al. 2001). At Brigham and Women's hospital clinicians spent about 2 per cent of their time writing orders which increased to 10-12 per cent following introduction of POE (Roesner, 2000). This translated into an average of 40 minutes longer per day writing orders. As physicians became more used to the system this reduced to an average of 20 minutes per day. Changes to the system to allow group orders for similar patients made a considerable impact on reducing time further.

Order entry systems also change the work practices of other health professionals, however the research literature is sparse on this topic. Murray et al (1998) undertook work sampling studies to assess the impact of POE on work patterns of pharmacists. Using a pre-post system implementation design they found pharmacists spent significantly more time checking prescriptions and problem solving and significantly less time filling prescriptions following POE implementation.

A study of the time taken for clinicians in an acute care setting to view test results available online found that 45 per cent of urgent accident and emergency department biochemistry test results and 29 per cent of ward requests were never accessed via ward terminals (Kilpatrick & Holding, 2001). Around one quarter of results were accessed within an hour of becoming available. A further 16 per cent were accessed between 1-3 hours. In 3 per cent of the accident and emergency department results which were never accessed, retrospective review showed that the findings may have led to an immediate change in clinical management (Kilpatrick & Holding, 2001). Improved efficiency in results reporting was not sufficient to improve clinical management and provides support for the need to understand clinical processes rather than focussing only on isolated clinical tasks.

Measures of improved efficiency as a result of electronic decision support systems have tended to adopt a narrow focus, such as time taken in the ordering process alone. A more holistic approach which considers efficiency across the entire clinical process, for example ordering of tests and retrieval and interpretation of results, is likely to provide a more accurate view regarding efficiency. The groups to whom efficiency gains accrue is also of importance and studies have rarely attempted to deal with this level of measurement complexity.

## 2.4 Critical role of electronic decision support systems evaluation

In general, approaches to the evaluation of electronic decision support systems are poorly conceptualised and implemented (Cushman, 1997; Heathfield et al. 1998). Some of the most frequent limitations are listed in Figure 1. While electronic decision support systems are often justified on the basis of clinical benefit, evaluation activities focus on technical issues and in some cases influence on clinical processes. Measurement of clinical outcomes is rare.

The central economic evaluation question is “What is the cost of delivery of the IT system and how does this relate to the benefits or value that have resulted?” (Bannister et al. 2001). The question has most frequently been tackled using traditional financial approaches to evaluate organisational interventions such as return on investment, net present value, internal rate of return and the payback period. However these have been found to be of limited value (Farbey et al. 1992). These techniques may work well for simple information systems interventions. For example, Dunbar (2000) presents an example of how a return on investment model might be applied to the assessment of an anaesthetic clinical documentation system, though he admits the financial benefits of the system could only be predicted with a very low degree of certainty. However such techniques are of limited usefulness in the evaluation of complex, multi-dimensional IT interventions such as electronic decision support systems (Protti, 2002).

The greatest challenge with these and other economic evaluation methods such as cost-benefit analysis, is that in addition to cost data, benefits need to be measured and assigned a monetary value. The first step in the process is identifying those costs to be included. While this often appears straight forward, as Bannister (2001) points out,

“The determination of IT costs can be just as difficult as IT benefits and in general the cost issue is not well handled.”

Some previous studies demonstrate how efficiency indicators such as number of dollars ‘saved’ as a result of reductions in the rate of adverse drug events, or changes

in the proportion of generic drugs used, may be calculated. These types of studies provide some indication of the return side of the IT investment, but ignore many other benefits for which a dollar value may not be assignable. True costing of the electronic decision support systems investment side is also complex and there is great debate about what should be included or excluded from such calculations.

An approach to achieve the desire to balance financial and efficiency goals of an organisation against effectiveness goals (eg improved quality of care, reduced deaths etc) is the balanced score card (Kaplan & Norton, 1992). This approach has been presented as one method for providing a way of evaluating organisational performance using multiple perspectives which marry performance indicators and organisational strategic goals. The rationale is that in order to manage a single or multiple organisations, single indicators are of only limited value and are subject to artificial manipulation with overall negative impact on other important indicators. The balanced score card approach advocates a range of indicators which focus on four system perspectives, namely, financial; effectiveness and efficiency of internal processes; the customer perspective and organisational learning and innovation (Van Grembergen & Van Bruggen, 1997; Protti, 2002). Each perspective has specified performance indicators and key strategic objectives.

Thus success of electronic decision support systems should be assessed by the extent to which the specified mix of indicators are improved. Such an approach however continues to rely upon a rigorous and well planned evaluation strategy which allows measurement of the specified indicators.

**FIGURE 1      Limitations of evaluation components of electronic decision support studies**

■ A focus on post-system implementation evaluation of users' perceptions of systems.
■ A reliance upon retrospective designs which are limited in their ability to determine the extent to which improvements in outcome and process indicators may be causally linked to the electronic decision support systems.
■ Rare adoption of a comprehensive approach to evaluation where a multi-method design is used to capture the impact of electronic decision support systems on multiple dimensions.
■ Concentration on assessment of technical and functionality issues, which are estimated to explain less than 20 per cent of IT failures. Such evaluations have also failed to determine why useful and useable systems are often unsuccessful.
■ Expectations that improvements will be immediate. In the short term there is likely to be a decrease in productivity. Implementing information systems takes time and measuring its impact is complex thus a long-term evaluation strategy is required but rarely implemented.
■ A review of decision-support evaluations found that almost none used a naturalistic design in routine clinical settings with real patients and most studies involved doctors and excluded other clinical or managerial staff.

## 2.5 Summary

Overall, the available evidence of the impact of electronic decision support systems to deliver improvements in the quality, safety and efficiency of health is promising. Reductions in medication and adverse drug events alone appear impressive, though evidence has been derived from a relatively small number of United States studies.

In assessing the research evidence it is important to understand the context in which study results were produced. To date the majority of studies have been undertaken in the United States and importantly, most have involved electronic decision support systems which have been internally developed and customized for individual health care organisations. The question as to whether the impressive results from systems such as those reported by Bates et al. which are custom built will be reproducible with “plug and play” commercial systems, is yet to be answered (Poikonen & Leventhal, 1999).

“..few if any commercial POE products undergo any pre-market testing similar to the evaluation of a new medication or medical device”  
(Gawande & Bates, 2000).

The effectiveness of electronic decision support systems which include decision-support elements is very dependent upon the quality of the knowledge databases and alert systems embedded. For example, Teich et al’s study which achieved substantial reductions in adverse drug events and changes in prescribing behaviour involved an order entry system which was developed internally and which relied upon a strong expert group to formulate drug recommendations which formed the basis for the drug intervention alerts. Producing care alerts is an arduous and complex process. It has been argued that,

“An organisation proceeding without an understanding of the need to implement and support custom medication rules and alerts and without providing them would be shortsighted” (Poikonen et al. 1999, p47).

The judicious use of alerts is also important. Studies examining the frequency of alerts in relation to action taken revealed a negative correlation – the more alerts generated the smaller percentage of instances action is taken.

Most studies have focused on the evaluation of physician order entry systems and thus the evidence regarding the impact other electronic decision support systems have is limited. Improvements in compliance with clinical guidelines are evident, however there is also considerable evidence that compliance is variable and related to many factors. In assessing studies of the effectiveness of electronic decision support systems in improving patient care processes and outcomes it is necessary not only to measure specific indicators eg proportion of medication errors, but to

understand the mechanisms leading to, ie the underlying causes, of those errors. Electronic decision support systems in general focus on specific clinical tasks, however to understand how electronic decision support systems can lead to improvements in health care, clinical tasks must be viewed within the context and totality of clinical work processes.



## 3 SURVEY AND INVENTORY RESEARCH METHODS

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### 3.1 Electronic decision support systems to be included in the evaluation

In our survey of the literature on implemented systems internationally and in Australia, electronic decision support systems were defined according to the National Electronic Decision Support Taskforce criteria. Specifically, electronic decision support systems were categorised into four types:

- Type 1** Provision of information that requires further processing and analysis by users before a decision can be made.
- Type 2** Trend analysis of patients' clinical status and/or clinical alerts.
- Type 3** Use of inference engines and a knowledge base to generate recommendations.
- Type 4** Systems with autonomous learning capabilities (eg case-based reasoning, neural networks, discrimination analysis).

The review inclusion criteria were developed after consultation with the Taskforce members. In our survey, we specifically only include electronic decision support systems that:

- Are in routine use
- Are used by clinicians (physician, nurse, allied health practitioner)
- Have been used within the last 5 years
- Provide clinical rather than management support
- Are not embedded into medical instruments.

Our review occurred in two stages:

- A literature review of the current status of electronic decision support implementation world-wide and in Australia
- An inventory of existing electronic decision support projects in Australia.

To ensure consistent information was collected about the projects reviewed, a data extraction and coding template was developed for use both in the literature review as well as the inventory, allowing some comparison of the two data sets to be made (Attachments A and B).



## 3.2 Literature review methodology

The literature review search strategy is described in Figure 2. Articles were retrieved if the project inclusion criteria were met and relevant data was then extracted using the template (see Attachment A). Classification problems were resolved by discussion. All review details and extracted information were entered into the project electronic database. To supplement the PubMed/Medline search, a manual search was also conducted. This included papers and websites that had been referenced by other papers, papers and authors or organisations known by reputation and review papers.

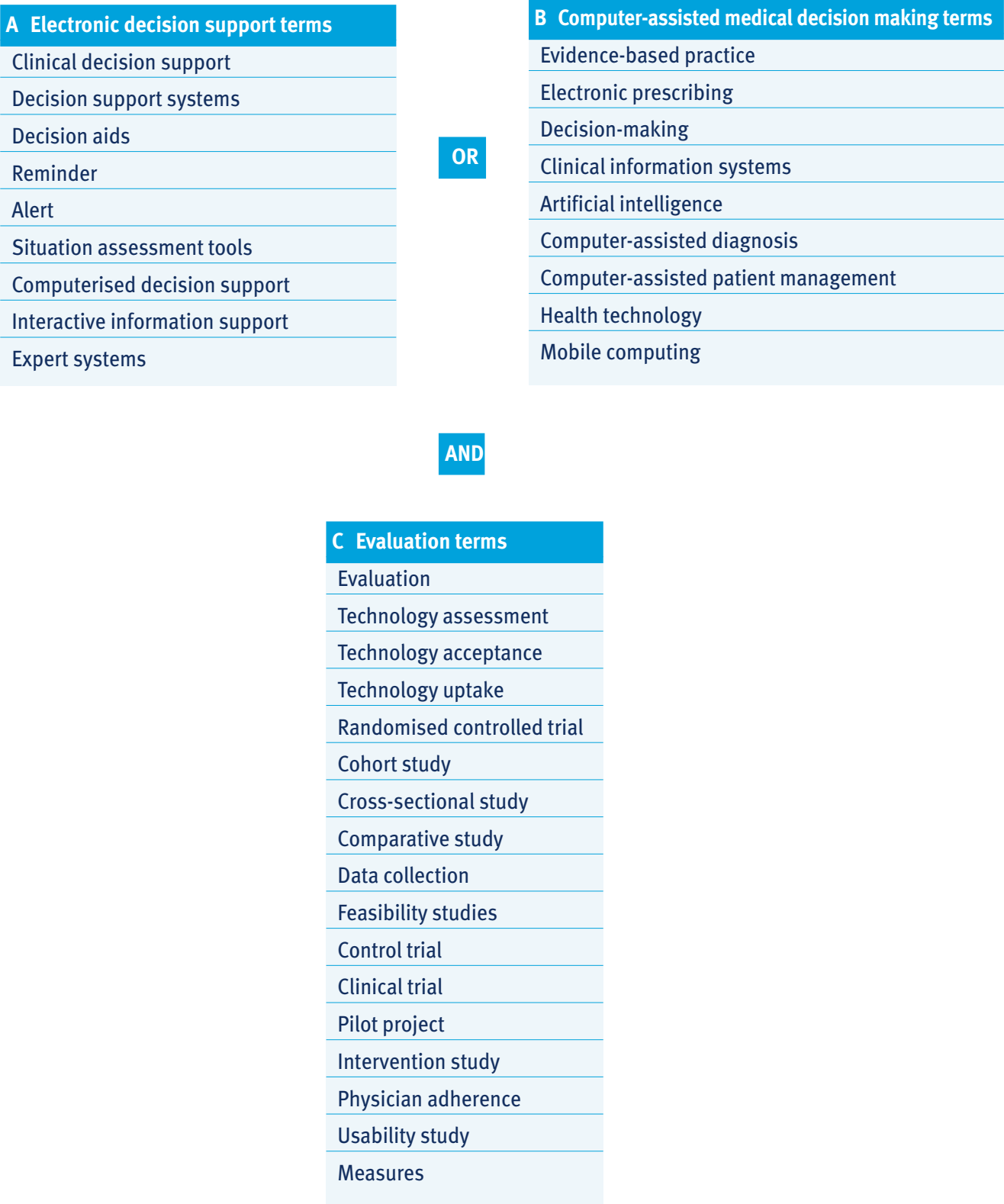
Our search yielded 60 papers, of which we selected a subset of 55 papers based upon the inclusion criteria (see primary literature sources in references section). These papers were restricted to those published in English between 1998 and the present, and which evaluated the use of a medical electronic decision support systems.

There are many papers published about such systems; for example, many of the papers published in the Journal of the American Medical Informatics Association (JAMIA) deal with medical electronic decision support systems. A large proportion of the published literature however contains descriptions of technology but does not involve a clinical evaluation of the system. In other published studies, a preliminary laboratory-based evaluation with simulated data was conducted, but no direct comparison was made against existing practices, nor against a gold standard. Both of these types of papers were excluded from the set of papers reviewed in this study.

## 3.3 Significant electronic decision support activities inventory

The inventory was created using a contact list of likely organisations and individuals who would either be directly involved in an electronic decision support project or be able to identify relevant ones. The contact list was based upon names provided by Taskforce members, as well as interviews with stakeholders. An initial list of 127 contacts was generated. Each name on the list was contacted using telephone and e-mail, and interviews were conducted when an electronic decision support project was identified, using the template to guide the data collection.

FIGURE 2    **PUBMED/MEDLINE search strategy for the literature review**



## 4 CURRENT STATUS OF ELECTRONIC DECISION SUPPORT IMPLEMENTATION WORLD-WIDE

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### 4.1 International literature review of electronic decision support projects

There are a growing number of reports of electronic decision support systems in the international academic literature. Electronic decision support systems are being applied in a wide range of clinical areas, for example, decision support in hepatic surgery (Dugas et al. 2002), diagnosis of chest pain (Aase et al. 1999), treatment of hypertension (Hetlevik et al. 1999 & 2000; Montgomery et al. 2000), management of tuberculosis (Dayton et al. 2000; Knirsch et al. 1998), asthma (Shiffman et al. 2000), diabetes (Hunt et al. 2001), chronic pain (Knab et al. 2001), prevention of venous thromboembolism (Durieux et al. 2000), management of mechanical ventilation (East et al. 1999; Jirapaet et al. 2001, McKinley et al. 2001), radiology diagnosis (Ikeda et al. 2000), ovarian stimulation (Lesourd et al. 2002), and classification of scintigrams (Lindahl et al. 1999).

There were two main areas of reported activity in the literature. The first of these is the implementation of electronic guidelines (Hetlevik et al. 1999 & 2000; Mikulich et al. 2001; Shiffman et al. 2000; Shojania et al. 1999; Smith & McNeely; 1999, van Wijk et al. 2002). The second is the implementation of systems to support the electronic prescription of drugs and medical tests (Abookire et al. 2000; Brown et al. 2000; Burke & Pestotnik, 1999; Chertow et al. 2001; Evans et al. 1998 & 1999; Kailajarvi et al. 2000; Persson et al. 2000; Raschke et al. 1998; Sanders et al. 2001; Shojania et al. 1999; van Wijk et al. 2002). These systems focussed on critiquing the orders placed by the clinicians and providing alerts and reminders.

The majority of the systems described in the literature (regardless of function) consisted of rule-based systems that linked to a knowledge-base. Systems that provided customised alerts, reminders and therapeutic recommendations also linked to an electronic patient record.

**TABLE 1**      **Distribution of reviewed papers by year (N=55)**

Year	Number of papers
1998	9
1999	13
2000	15
2001	13
2002	5

**TABLE 2**      **Percentage of electronic decision support systems in the reviewed literature at each of the four types (N=55)**

Type	%
Type 1	16.36%
Type 2	20.00%
Type 3	60.00%
Type 4	3.64%

Most of the systems described in the literature were at Type 2 or Type 3 (Table 2). Clinical trials of Type 4 systems, such as those using neural networks, are rarely reported in the literature, despite the large body of literature describing the technology of such systems. Literature dealing with Type 4 systems tends to detail the construction of the system, rather than their evaluation in a clinical setting. For example, Atienza et al (2000) used a simple neural network to assess one-year prognosis in 132 heart failure patients, by classifying them into 3 groups: death, readmission and 1-year event-free survival. The accuracy of one-year prognosis was 93.2 per cent with only 9 individuals misclassified. However, no comparison was made to current classification rates of experts, nor was the system given to physicians to use. As a result no conclusions about the effect of the system on clinical practice nor on patient outcomes were drawn.

**TABLE 3**      **Settings in which reviewed electronic decision support systems were implemented (N=55)**

Setting of projects	%
Hospital	54.55%
Laboratory	21.82%
Primary Care	16.36%
Hospital Pharmacy	3.64%
Specialist Rooms	1.82%
Community Pharmacy	1.82%

Over half of the electronic decision support studies reviewed were undertaken in hospitals, 22 per cent in a laboratory and 16 per cent in primary care (Table 3).

**TABLE 4** Countries in which reviewed electronic decision support systems were implemented (N=55)

Location	%
USA	54.55%
UK	10.91%
Norway	7.27%
Canada	3.64%
France	3.64%
Netherlands	3.64%
Sweden	3.64%
Finland	1.82%
Germany	1.82%
Ireland	1.82%
Japan	1.82%
Spain	1.82%
Thailand	1.82%

All but four of the studies reviewed were undertaken in the United States or Europe. No published Australian studies fitting the selection criteria were identified.

## 4.2 Evaluation of electronic decision support systems in the literature

The electronic decision support studies reviewed applied a range of evaluation techniques. The criteria that were used to select studies for review led to a bias towards studies using formal comparison evaluation techniques such as randomised controlled trials, before/after studies and case-control studies as Table 5 shows. In all but one case, the evaluation was carried out internally.

**TABLE 5 Evaluation methodologies used in the reviewed electronic decision support studies (N=55)**

Evaluation Methodology	%
Before/after sample	27.27%
RCT	23.64%
Case-control	21.82%
Case study	16.36%
Qualitative	5.45%
Not done	3.64%
Longitudinal study	1.82%

Overall, in about 25 per cent of papers some attempt was made to measure clinical process effects of electronic decision support systems via variables such as changes to confidence in decision, costs and adherence to protocols. Less than 10 per cent of papers attempted to measure impact of electronic decision support systems on outcomes, and only one demonstrated an improvement.

**TABLE 6 Impact of electronic decision support systems in evaluation studies reviewed (n=55)**

	Impact measured		Impact not measured
	IMPROVEMENT DEMONSTRATED (NO. OF STUDIES)	NO SIGNIFICANT IMPACT (NO. OF STUDIES)	(% OF STUDIES)
<b>Process variables</b>			
Confidence in decision	12	3	40 (73%)
Patterns of care	15	4	36 (66%)
Adherence to protocol	10	4	41 (75%)
Efficiency/Cost	10	2	43 (78%)
Adverse effects	12	3	40 (73%)
<b>Clinical outcomes</b>			
Morbidity	1	5	49 (89%)
Mortality	0	3	52 (95%)

*Confidence in decision support systems:* 15 studies considered whether confidence in decision was affected by use of an electronic decision support system. Of these, 12 found a significant improvement in clinical confidence and 3 found no change in clinical confidence level.

Several electronic decision support systems used to assist in diagnosis led to a significant improvement in diagnostic accuracy and subsequent improvement in decision confidence (Aase 1999, Firestone et al. 1998, Friedman et al. 1999, Ikeda et al. 2000, Jirapaet 2001). For example, Aase (1999) found that using an electronic decision support system to diagnose acute chest pain resulted in the number of unnecessary referrals to the Coronary Care Unit (CCU) being reduced from 35 per cent to 19 per cent, and the number of patients in need of CCU observation misallocated to a general ward was reduced from 13 per cent to 10 per cent. Friedman et al. found that clinicians' diagnostic performance improved from 39.5 per cent to 45.4 per cent when an electronic decision support system was used to assist in the diagnosis of 36 difficult cases with known diagnoses.

Eight studies of systems that were designed to provide therapeutic and management advice, usually based on a set of published guidelines, reported an increased confidence in decision (Dayton et al. 2000, Emery et al. 2000, Kellet 2001, Knab et al. 2001, Lesourd et al. 2002, Medow et al. 2001, Smith et al. 1999, Thomas et al. 1999). Increased compliance with the guidelines by physicians led to better practice, as well as more uniform standards of care amongst the participating physicians. In a randomised controlled trial, Dayton et al (2000) found that an electronic decision support system improved adherence to tuberculosis treatment guidelines, leading to the intervention group correctly using therapy in 95.8 per cent of cases, compared to 56.6 per cent for control cases. Emery et al (2000) reported similar outcomes when an electronic decision support system was used in primary care to aid in the management of familial breast and ovarian cancer.

The electronic decision support system as a diagnostic tool actually had a confounding effect in 6 per cent of cases in one study (Friedman et al. 1999). Friedman found that when their electronic decision support system was used by clinicians to diagnose difficult cases, the rate of correct diagnosis increased from 39.5 per cent before to 45.4 per cent when the electronic decision support system was used, but in 6 per cent of cases, the clinician actually changed from the correct diagnosis to an incorrect diagnosis after referring to the electronic decision support system. In this study, the electronic decision support system advised the correct diagnosis for 40.6 per cent of cases.

*Patterns of care:* 34 per cent (n=55) of studies measured the way in which the clinicians cared for their patients. In 28 per cent, they found that using the electronic decision support system did have a significant effect on the patterns of care. In 10 of the studies this was effected through an improved adherence to protocol by means of an electronic guideline. This was particularly true of the integrated electronic decision support/physician order entry systems (Chertow et al. 2001, Dexter et al. 2001, Durieux et al. 2000, Evans et al. 1998, Monane et al. 1998, Morrissey 2002, Raschke et al. 1998, Sanders & Miller 2001, Shojania et al. 1998, van Wijk et al. 2001).

A number of studies found that clinicians changed their practices on the basis of electronic decision support system recommendations. For example, in an analysis of tuberculosis patients, Knirsch et al (1998) found that use of their electronic decision support system, had it been used, could have achieved a significant improvement in tuberculosis patient isolation rates (75 per cent of 171 patients instead of 51 per cent,  $p < .001$ ). Ruland (2002) reported on the implementation of a handheld electronic decision support system for preference-based care planning, which assisted nurses in eliciting patients' preferences for functional performance at the bedside. After implementation of the system, nurses' decisions were more consistent with patient preferences, and improved patient preference was achieved (155 patients). In a randomised controlled trial, Shojania et al (1998) found use of a computerised guideline for intravenous vancomycin as part of a physician order entry system led to a 30 per cent reduction in the use of vancomycin with a 36 per cent reduction in duration of therapy compared to clinicians not exposed to the guidelines. Dexter et al (1998) found that the use of computer-generated reminders resulted in an increase in the frequency of advance directive discussions between patients and their primary caregivers and the frequency of consequent establishment of advance directives.

However, changes in patterns of care introduced by use of the electronic decision support system did not necessarily lead to improved care. Shiffman et al (2000) found that the introduction of an electronic decision support system with the clinical guidelines for office management of asthma changed patterns of care, resulting in increased measurements of peak expiratory flow rate, increased administration of nebulized beta2-agonists and longer consultations. This led to an increase in costs per visit, but had no measurable effect on immediate disposition or subsequent emergency department visits, hospitalisations, missed school, or carers' missed work, during the 7 days post visit.

Not all studies found that the electronic decision support system had an impact on patterns of care. Rocha et al (2001) implemented an electronic decision support system to detect and manage infections in a paediatric hospital and found no statistical difference between clinicians' treatment strategies before and after implementation. Hetlevik et al (1999, 2000) implemented a system of clinical guidelines for diabetes mellitus in general practice with a specific electronic decision support system as part of the intervention. They found no clinically significant change in doctors' behaviour or in patient outcomes between control and intervention groups. A before and after study (Kellet 2001) of an electronic decision support system designed to increase the appropriate use of fibrinolysis in 894 patients with myocardial infarction found no significant increase in the percentage of patients appropriately receiving fibrinolysis after the electronic decision support system was introduced. However, time between consultation and injection was significantly decreased after implementation of the electronic decision support system, and this was regarded as an improvement due to the system.



Several studies (Burke & Pestotnik 1999, Dexter et al. 1998) found that clinicians would consider the recommendations of the electronic decision support system when making a decision, but would not rely on its recommendations. Less experienced doctors were more influenced by the electronic decision support system than more experienced doctors (Friedman et al. 1999). Some authors cited non-compliance with system recommendations as a barrier to success of the system. Abookire et al (2000) found that physician compliance to the recommendations of an allergy alert electronic decision support system decreased over time (from 51 per cent to 27 per cent for definite alerts, and from 46 per cent to 20 per cent for possible alerts over a 5 year period).

*Efficiency/Cost:* Few of the studies had cost or efficiency as primary outcome measures. One reason for this was that many systems were not sufficiently established to provide data for a rigorous cost-benefit analysis.

A number of studies did report time and cost savings. However the reported evaluations were generally very simple, and the savings were extrapolated from the limited data gathered. For example, some studies found that using an electronic decision support system resulted in less physician ordering, which led in turn to reduced costs. Time savings were reported as: it takes a clinician  $m$  minutes to come to a decision without the electronic decision support system and  $n$  minutes with the system; thus the system introduces a time saving of  $(m-n)$  minutes. The cost savings were typically extrapolated from a reduction in physician ordering (Bates et al. 1999, Burke et al. 1999, Evans et al. 1999, Persson et al. 2000, Smith et al. 1999), or a reduction in hospital bed-days (Evans et al. 1998). These analyses did not take into account costs such as that of implementing and maintaining the electronic decision support systems, nor of training staff in its use. Persson et al. (2000) provides a typical example: “The decision support systems suggested significantly more thiazides and significantly fewer calcium antagonists than the physicians had prescribed, with a total cost reduction of 33-40 per cent, depending on doses chosen.”

On the other hand, Shiffman et al (2000) found that as a result of their intervention, visits lasted longer and fees were higher (\$145.61 vs \$103.11), but, although clinician adherence to guidelines was increased, no improvement could be demonstrated with regard to the observed intermediate-term patient outcomes.

*Adverse effects:* Adverse effects were one of the primary measures in the studies dealing with drug prescribing. These systems provided warnings, alerts and critiques of physician ordering, and one of the measures of system success is a reduction in the number of Adverse Drug Events (ADEs) and potential ADEs that occurred. These were normally measured by the number of orders that were changed as a result of recommendations by the electronic decision support system. The most successful systems were those that alerted the physician at the time of ordering (Evans et al. 1999, Morrissey 2002), and forced the ordering physician to acknowledge the

system’s recommendation, rather than those that alerted retrospectively, and those that provided warnings that could be ignored (Dexter et al. 2001, Durieux et al. 2000).

Changes in adverse events following the implementation of electronic decision support systems designed to assist diagnosis have been reported. Bates (1999) reported a significant increase in the detection of certain types of adverse drug events. Most authors reported a significant reduction in the rate of adverse effects with the introduction of the decision support systems (Evans et al. 1998, 1999, Bates et al. 1998, Burke & Pestotnik 1999, Chertow et al. 2001, Friedman et al. 1999, Raschke et al. 1998, Nightingale et al. 2000, Monane et al. 1998, McMullin et al. 1999).

*Morbidity and Mortality:* Clinical outcomes were infrequently measured.

**TABLE 7      Number of studies that measured morbidity and/or mortality as a study outcome**

Number of studies	Measured	Not measured
Morbidity	6	49
Mortality	3	52
Both morbidity and mortality	2	53

Both Hetlevik and Montgomery conducted randomised controlled trials in which electronic clinical guidelines were assessed as an intervention in management of hypertensive patients. Neither study found any significant difference between the blood pressures of the control and intervention groups. Although both used morbidity as a primary outcome, neither found a significant impact due to the electronic decision support system.

On the other hand, East et al (1999) reported a significant reduction in morbidity, incidence and severity of overdistension lung injury in the protocol group when an electronic decision support system was used to assist with ventilator management for respiratory diseases.

### 4.3 Electronic decision support systems development methodology

Almost all of the investigators used systems that had been developed at the particular research institution. The papers gave little detail about the systems design process used. The knowledge bases incorporated into the electronic decision support systems were usually developed using in-house expertise. Typically, papers cited that the electronic decision support system was developed from some combination of local clinician expertise (including in-house clinical policies and procedures), published clinical guidelines and a review of the published literature.

**TABLE 8      Percentage of studies that used commercial, in-house and published data to design the electronic decision support system. Many studies used a combination of these resources**

	%
Commercial Database	1.8%
In-house Data	61.8%
Published Data	45.5%

In terms of evaluation, the studies appeared to be very specific to the implementation setting. Each of the systems was different in terms of clinical (disease specific) application, interface useability, procedures and method of use, point of application in the clinical care pathway, level of electronic decision support system hardware and software integration into the existing infrastructure, etc. This complete lack of standardisation in system or methodology means that it is difficult to make any direct comparisons between systems.

In some instances a system was reported as having no effect on the outcome measures, while another similar study reported having a large positive effect. For example, Hetlevik et al (2000) found that implementation of clinical guidelines via electronic decision support systems had no clinically significant change in doctors' behaviour or in patient outcome, whereas Shiffman et al (2000) found significant increases in the number of measurements made and the length of consultations when an electronic decision support system implementation of clinical guidelines was implemented, and Shojania et al (1998) reported a significant reduction in the use of vancomycin when a guideline-based electronic decision support system was used. At this stage, from the current literature, the cause of these differences cannot be identified.

For example, system parameters such as the user interface, the time and location at which it was used, how transparent the system was to the user, the level of feedback

and the information provided to the user were not controlled for. The outcomes in the literature suggest that systems that are specifically customised to their environment, so as to fit into local practice patterns, standards of care and local workflow issues, are better accepted. For example, Hetlevik et al (1999) felt that their system was too general and too large, and that a system more specifically tailored to their needs would have been better accepted. On the other hand, increased specificity leads to lack of generalisability and transferability of the system.

## Conclusions

There is a wealth of knowledge embedded in the literature that is readily available. However, critical appraisal and detailed comparison of the papers is difficult due to a lack of standardisation of methodology for project planning, for electronic decision support systems implementation in the chosen setting, for evaluation of the electronic decision support systems in the clinical context, and for reporting in peer-reviewed scientific publications.

It is noted that electronic decision support systems have highly variable functionality, eg diagnostic support, therapeutic treatment decisions, monitoring, alerting or critiquing, which is not easily categorised to permit comparisons of results. In the published literature, important system parameters including the user interface, the time and location at which it was used, how transparent the system was to the user, the level of feedback and the information provided by the electronic decision support systems were not controlled in the evaluation. These would appear to be fundamental differences that limit the ability to generalise from the results of specific individual studies.

The overwhelming majority of published reports involve electronic decision support systems that have been developed and customised for individual health care organisations. Each system appears to be developed with its own standards and infrastructure on an individual project basis.

Notwithstanding these limitations, it is apparent that electronic decision support systems are being applied in institutional health care settings (75 per cent in hospital and laboratory) for alerting and critiquing (in physician order entry systems) and for diagnostic/therapeutic advice (using electronic clinical guidelines). The majority of publications had positive comments to make about the introduction of their electronic decision support system in a clinical setting.

## 4.4 Potential biases in the literature review

This selection of papers introduces an inherent bias into the information gathered. Clinical papers naturally focus on clinical aspects of the application of technology, rather than on the engineering aspects of the development.

The literature appeared biased towards successful studies, suggesting that studies in which the electronic decision support system was not successful, and the reasons for this, are less available through the literature.

## 4.5 Electronic decision support systems operating overseas

An International literature and web-based resources search identified a small group of electronic decision support systems currently in use overseas (Table 9). Several electronic decision support systems have been in routine use for decades. All systems listed provide Type 2, Type 3 and Type 4 decision support. The majority of systems in use are single-institution systems implemented and maintained in one healthcare setting. Prodigy is a rare example of a nation-wide deployment of an electronic decision support system, supporting prescribing decisions in general practice in the United Kingdom.

The National Guideline Clearance House in the United States (<http://www.guideline.gov/index.asp>) is a rare example of a system with international reach, although it is only marginally classifiable as a Type 1 electronic decision support system.

**Table 9. Examples of electronic decision support systems currently in use overseas**

Name of system	Health care setting	Commissioned
HELP (Health Evaluation through Logical Processing)	LDS Hospital, Salt Lake City, Utah	1980
Electronic Medical Records	Department of Veteran Affairs Medical Center, Washington DC	1990
ADE (Adverse Drug Event) Monitor	Barnes Hospital, St. Louis, Missouri and Washington University School of Medicine	1995
Colorado Medical Utilisation Review System	Colorado Health Centre, Denver	1990
GermAlert and GermWatcher	Barnes Hospital, St. Louis, Missouri	1993
DoseChecker	Barnes Hospital, St. Louis, Missouri	1994
DXplain (Diagnostic decision support in general medicine)	Massachusetts General Hospital	1987
Clinical Event Monitor	Columbia-Presbyterian Medical Center	1992
PRODIGY (Project prescribing rationally with Decision-support In General-practice study)	Nation-wide implementation in Great Britain	1995
ERA (Early Referrals Application)	GP practices linked to University Hospitals of Leicester NHS Trust, UK	2001
QMR (Quick Medical Reference)	University of Pittsburgh, University of Alabama at Birmingham	1972
POEM (PostOperative Expert Medical System)	St. James University Hospital, Leeds, UK	1992
SETH (Expert System in Clinical Toxicology)	Poison Control Centre, Rouen University Hospital, France	1992
ACORN	Westminster Hospital, London, UK	1987
TherapyEdge HIV (Web-enabled decision support system for the treatment of HIV infection)	Subscription via Internet	2001
MDDB (Diagnosis of dysmorphic syndromes)	Kinderzentrum, Munich, Germany	1995
NeoGanesh (Management of Mechanical Ventilation in Intensive Care)	Hospital Henri Mondor, Créteil, France	1997
VIE-PNN (Vienna Expert System for Parenteral Nutrition of Neonates)	Neonatal Intensive Care Unit, Department of Paediatrics, the University of Vienna, Austria	1996
PUFF (Pulmonary function test interpretation)	Pacific Presbyterian Medical Center, San Francisco, California	1977

See <http://www.openclinical.org/aisdss.html> for further details

## 5 INVENTORY OF ELECTRONIC DECISION SUPPORT INITIATIVES IN AUSTRALIA

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We interviewed 127 individuals representing a broad range of public and private healthcare organisations, professional bodies, the academic sector and medical software industry. We have been able to identify 35 significant electronic decision support systems in routine use in Australia. They represent systems developed and used in a healthcare settings within the last 5 years. A complete listing of the Inventory is attached as Attachment D.

### 5.1 Geography of electronic decision support activities in Australia and setting of projects

Almost 50 per cent of projects are multi-state or National. Projects are occurring in every State/Territory, the majority in the more populous states (New South Wales and Victoria) predominantly in Primary Care (40 per cent) and Hospital (28 per cent) settings (Table 10). The predominant healthcare setting for electronic decision support system implementation appears to be the primary care. This may reflect the significant improvement in general practice computerisation and this view is supported by the Needs Analysis report released by Australian Divisions of General Practice in April 2002 (Mr Mark Brommeyer, Personal Communication, July 2002). The report stated that computerisation has occurred in 87 per cent of Australian practices. A significant increase in electronic diagnosis and treatment support was identified with drug interaction prompts in effect in 75.6 per cent of practices and scripts generated electronically in 78.3 per cent of practices surveyed. Our findings reflect this general trend and confirm that electronic decision support systems are often becoming inter-organisational.

### 5.2 Type of support and system functions

Our data show that most systems in use provide Type 1 (43 per cent) or Type 2 (43 per cent) decision support and that the estimated number of users is reasonably high. Sixty percent of respondents estimated their system has more than 100 users, 91 per cent have more than 10 users (Table 11). Most electronic decision support

systems provide information retrieval functions (74 per cent), corresponding with Type 1 decision support. Only 9 per cent of systems provided support at Type 4.

The majority of systems in the inventory identify therapy planning and management (54 per cent) as a focus of system functionality ie, providing information on drug dosing and interactions, therapy alerts and prescribing guidelines. Fewer systems (26 per cent) provide support for diagnosis. Nine systems (26 per cent) can provide interpretive information for patients/consumers (Table 12).

The most commonly used knowledge sources were published guidelines (60 per cent) and in-house expert opinion (57 per cent). 43 per cent of systems, primarily in hospital settings, used commercial databases. The aims of electronic decision support systems may vary, but two of the most relevant are improving patient outcomes and increasing the application of clinical management guidelines. This reflects observation made by Talman et al (2001) that construction of computer-based decision support in Australia have mainly been for the conversion of clinical management guidelines that are generated by specialty guilds or organisations like the National Health and Medical Research Council.

**TABLE 10 Project settings by location**

Project location	Setting of projects							Total no.
	PRIMARY CARE	HOSPITAL	HOSPITAL PHARMACY	COMMUNITY CARE	COMMUNITY PHARMACY	PATHOLOGY	MULTI-SETTING	
National/Multistate	8	2			1	2	4	17
New South Wales	2	3		1				6
Victoria	3	2					1	6
Queensland		1						1
Western Australia								0
South Australia	1	1						2
Northern Territories		1						1
Tasmania					1		1	2
<b>Total ( per cent)</b>	<b>14 (40)</b>	<b>10 (28)</b>	<b>0</b>	<b>1 (3)</b>	<b>2 (6)</b>	<b>2 (6)</b>	<b>6 (17)</b>	<b>35 (100%)</b>



**TABLE 11      Types of decision support by estimated frequency of use**

Setting	No. of systems	Level of support				Frequency of use		
		TYPE 1	TYPE 2	TYPE 3	TYPE 4	<10	10–100	>100
Primary Care	14	4	9	1		1	2	11
Hospital	10	4	4	1	1		5	5
Community Care	1	1						1
Hospital Pharmacy	0							
Community Pharmacy	2	1	1				1	1
Pathology	2				2	1	1	
Multiple settings	6	5	1			1	2	3
<b>Total (%)</b>	<b>35</b>	<b>15</b>	<b>15</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>11</b>	<b>21</b>
	<b>(100%)</b>	<b>(43)</b>	<b>(43)</b>	<b>(9)</b>	<b>(9)</b>	<b>(9)</b>	<b>(31)</b>	<b>(60)</b>

**TABLE 12 Systems functions and knowledge sources**

Setting	No. of systems	System functions					Knowledge sources		
		INFO RETRIEVAL	ALERTS	DIAG-NOSIS	THERAPY	CLINICAL AUDIT	PUBLISHED	COMMER-CIAL	IN-HOUSE
Primary Care	14	14	4	5	9	4	9	3	7
Hospital	10	9	6	2	7	4	6	7	7
Community Care	1	1	1				1		
Hospital Pharmacy	0								
Community Pharmacy	2	1	2		1	1	1	2	1
Pathology	2		1	2	1				2
Multiple settings	6	1	3		1	2	4	1	3
<b>Total (%)</b>	<b>35</b>	<b>26</b>	<b>17</b>	<b>9</b>	<b>19</b>	<b>11</b>	<b>21</b>	<b>13</b>	<b>20</b>
	<b>(100%)</b>	<b>(74)</b>	<b>(48)</b>	<b>(26)</b>	<b>(54)</b>	<b>(31)</b>	<b>(60)</b>	<b>(37)</b>	<b>(57)</b>

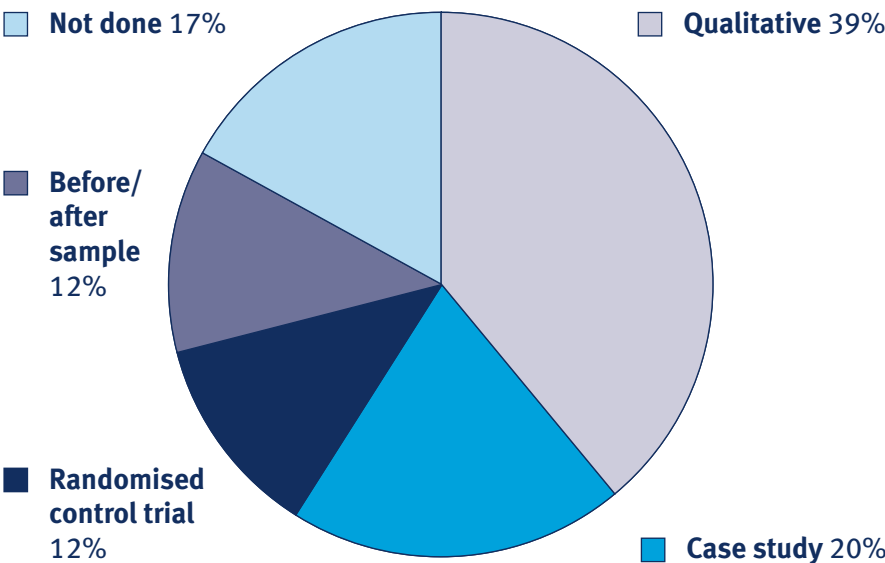
## 5.3 Evaluation methodologies used in electronic decision support projects

About 17 per cent of systems surveyed had no formal evaluation, usually due to a claimed lack of project resources (Figure 3). For nearly 60 per cent of projects, evaluation consisted only of a case study, or some form of qualitative analysis. Qualitative methods, conducted in 39 per cent of projects, included focus groups, descriptive studies and user surveys. They typically were used to assess user acceptability of systems, but not against any objective usability standards. Only 27 per cent carried out any rigorous form of evaluation either through a before-after study or a randomised controlled trial. Only 12 per cent of systems were tested in randomised control studies.

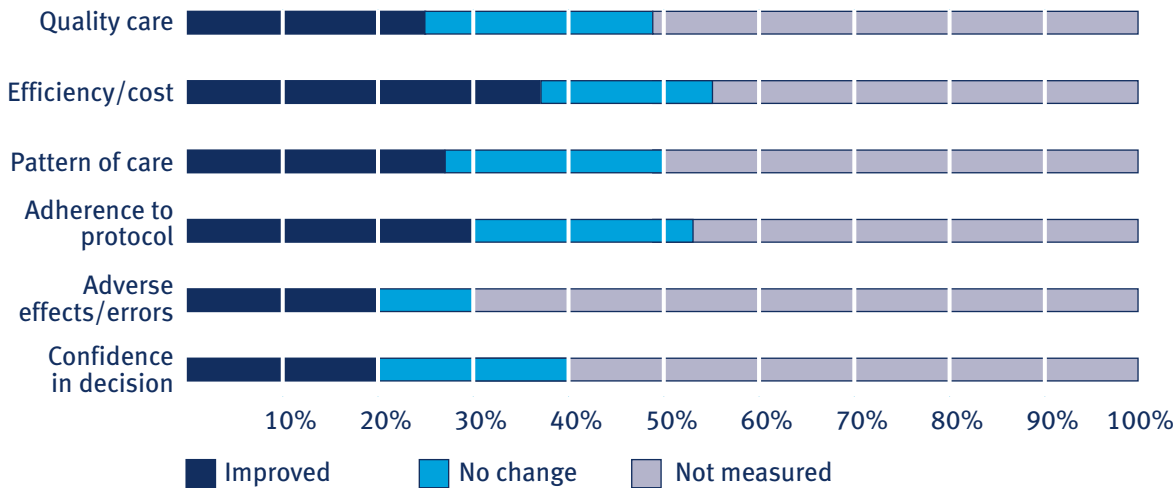
The absence of significant evaluation of the impact of a system on clinical process or outcome in the majority of systems in the inventory makes it difficult to estimate the magnitude of their impact in health care, despite the good evidence from the primary literature that such an impact is likely to exist.

Specifically, only 5 projects out of 35 projects attempted to measure patient outcomes. Figure 4 shows that less than half of the projects aimed to assess the impact of electronic decision support systems on clinical process measures, and of these, only about a half demonstrated improvements. In regard to process measures of evaluation used in projects it appears that quality of care and cost are the most often evaluated, however overall less than one-quarter of projects in our survey demonstrated any impact on process measures.

**FIGURE 3** Evaluation methodologies applied to electronic decision support projects



**FIGURE 4** Process measures assessed in electronic decision support system evaluations



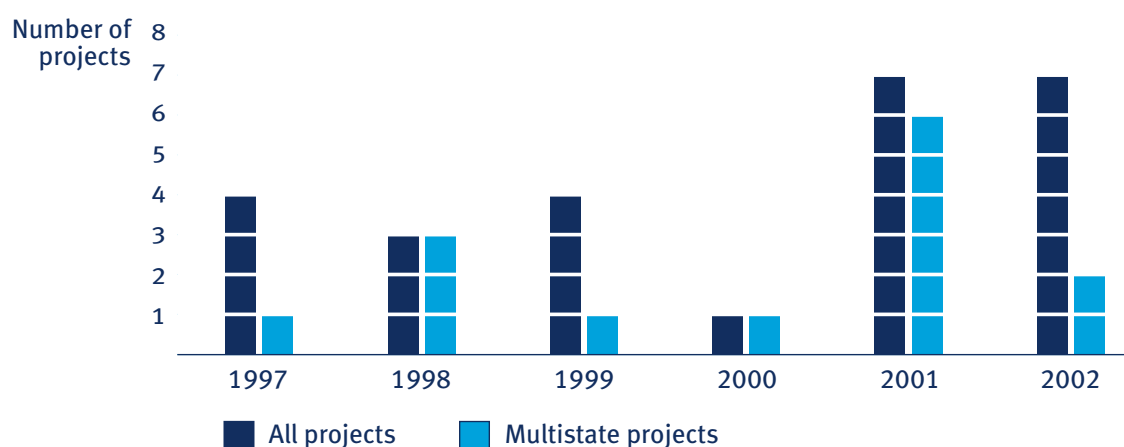
## 5.4 Investment into electronic decision support systems

Government is the driver of the Australian electronic decision support systems sector. Over two thirds of projects were funded predominantly by government. A small number of projects accounted for the bulk of the investment, and typically these are funded Federally, for example the Better Medication Management System. Amongst the projects reported in the inventory as being 'in progress', 24 (68 per cent) were predominantly funded by government and 11 were industry supported. Figure 5 shows the distribution of the electronic decision support projects by year.

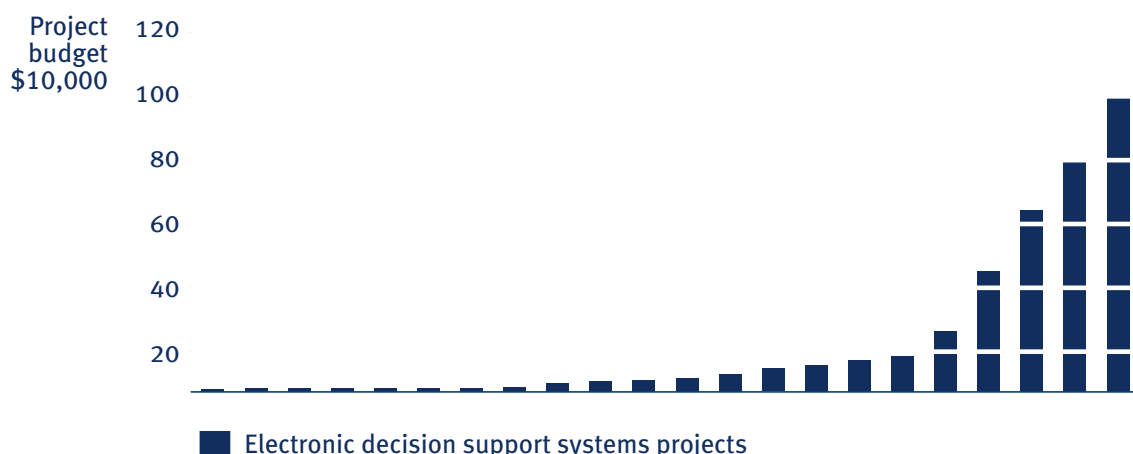
Almost one third of respondents (10 out of 35) opted not to disclose budgets of their electronic decision support projects. The distribution of inventory projects' budget is shown in the Figure 6. Two large-scale government-funded projects (Better Medication Management System – \$134 million and General Practice Electronic Decision Support – \$52 million) are not included in the graph. As clearly seen, the majority of inventory projects are relatively low-budget activities (Figure 6).

Industry routinely reports that, on the occasions when it is asked to undertake IT projects, it does not have spare capacity to undertake such projects, because of the intermittent nature of funding and the difficulty in retaining staff during lean times. The fragmented nature of the medical software industry also means that there is little capacity to undertake research and development in-house. Yet electronic decision support systems at type two and upwards require the use of knowledge-based technologies, which are still not widespread in the IT industry and would require some research and development capacity for many software houses to be in a position to develop them.

**FIGURE 5**     **Distribution of electronic decision support projects by year**



**FIGURE 6**    **Distribution of electronic decision support projects by budget**



## 5.6 Comparison between published international electronic decision support studies and Australian electronic decision support inventory projects

The International and Australian datasets differed in a number of ways. However, it is unclear whether these differences represent significant variations in the International and Australian electronic decision support systems experience, or simply reflect variations in the data collection methodologies. Specifically, the International literature data set captures electronic decision support systems that have been reported in the academic literature, and the Australian data set represents interview data from individuals associated with working clinical systems. It is likely that there is a significant publication bias in the literature. Typically an electronic decision support system in the literature appears because of its technical novelty or because of an attempt to rigorously demonstrate changes in outcomes. Electronic decision support systems that are in routine use that do not represent technically novel solutions, and are not part of a large evaluation study, are unlikely to appear in the literature. Many of the systems we captured in the inventory fall into this category. Consequently, while we now report differences in the two data sets for discussion purposes, and offer potential reasons for the differences, we cannot say whether these differences are significant.

### Number of users and project setting

A considerably higher proportion of projects in the inventory related to electronic decision support systems designed for a large number of users (>100) compared to those electronic decision support systems reported in the literature. Reasons for this might include:

- publication lag resulting in a failure of the literature to represent the current increasing activity in electronic decision support systems development, and
- the high proportion of publicly funded electronic decision support projects in Australia designed for large user groups.

Reports of hospital electronic decision support systems dominate the published literature, representing around two-thirds of systems reported. Primary care studies make up around 16 per cent of published reports. In contrast, the inventory projects were more balanced with around one third related to primary care and a further third consisting of hospital based systems. This may reflect the greater research culture within hospitals where there is a greater tendency for project teams to publish their findings compared to general practice based professionals. It may however more likely be an artefact of publication bias.

## Funding source

In only 54 per cent of published studies was the funding source revealed. Of those studies, two thirds were publicly funded and around 10 per cent were privately funded. The remainder received either mixed or no funding. Within the project inventory approximately 40 per cent were public funded projects and 13 per cent were privately funded. These rates were therefore not dissimilar from the published studies.

## Type

Over 80 per cent of inventory projects were at Type 2 or below. In contrast, only 38 per cent of published electronic decision support systems were in this category. This is likely to be due to a publication bias towards more complex and sophisticated systems that are technically innovative from a scientific point of view.

## Knowledge sources and functions

Nearly all published studies (64 per cent) reported systems developed in-house, however, only approximately 2 per cent could be identified as commercial systems, with the balance (32 per cent) unable to be identified from the papers. Within the inventory 50 per cent of projects were in-house, 40 per cent were commercial and 10 per cent published data. Industry is considerably less likely to use academic publications as a vehicle to disseminate information and therefore this may explain the disparity found. Inventory projects had a greater proportion of projects which included information retrieval, alerts and therapy planning compared to the published studies. However these three functions were ranked as the top three in both datasets.

## Evaluation

Nearly all published projects were evaluated internally, while only one third of inventory projects were internally evaluated, and one third had combined internal/external assessors. While 52 per cent of published studies reported the use of a randomised controlled trial or pre-post system evaluation design, only 23 per cent of inventory studies used these methods. A likely reason for the disparity is that some form of rigorous evaluation is usually a prerequisite for publication in the literature.

## 6 ENABLERS AND BARRIERS FOR ELECTRONIC DECISION SUPPORT SYSTEMS SUCCESS

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### 6.1 Factors influencing successful implementation of electronic decision support systems

A wide range of factors has been advanced as being important in achieving successful electronic decision support system implementation. The extent of supporting research evidence is variable. For example, Weir et al (1994) compared hospitals which had been successful or unsuccessful with electronic decision support system implementation, namely an order entry system with prescription decision support. Success was determined by two measures; reported use of the system by participants in the study and ratings by software engineers within the health care organisations studied. A mailed questionnaire was completed by 40 hospital staff (20 from unsuccessful and 20 from successful hospitals). Comparisons between the two hospital groups showed that when asked what factors led to successful implementation of electronic decision support systems, staff at the successful hospitals reported support from management, direct involvement of clinicians, and adequate number of terminals significantly more often than did staff from unsuccessful hospitals.

The most frequently reported barrier to electronic decision support systems use was system functionality. However, successful and unsuccessful hospitals were equally likely to report technical and functionality barriers to use eg speed. While this study had several methodological limitations, including a small sample size, the results are supported by other studies. Gosling et al (2002) undertook cases studies of hospitals with high and low rates of use of an online evidence retrieval system. Staff from high and low use hospitals were equally likely to complain of technical and functionality issues, eg speed and access. Factors which distinguished high and low use hospitals however related to professional, organisational and socio-cultural factors. For example, clinicians from high use hospitals were more likely to perceive organisational support for the use of online evidence in their work and a culture in which information-seeking was legitimised.

Implementation of electronic decision support systems requires significant changes in the way clinicians do their work. Early adopters of systems in the United States found that failure to address the major cultural impact of the system on the workforce resulted in fewer than anticipated benefits. Reasons for failure have been



attributed to a failure of electronic decision support systems to fit the practice patterns of doctors, or because leadership for the implementation process was lacking, or both. Thus successful implementation must encompass a model for organisational change and not rely solely on an IT project management model for implementation.

Organisations that research and evaluate the impact of electronic decision support systems and devote adequate resources to these tasks are more successful in achieving benefits (Roesner, 2000). Berg (2001) describes implementation of electronic decision support systems as a “process of mutual transformation”. The organisation is affected by the technology, and the technology is influenced by organisational dynamics. As such implementation should be viewed as

“.. a process of organisational development..[PoCCs] can be intended strategically to transform the organisation, and the technology can be allowed to grow along, gradually becoming part and parcel of the basic organisational work routines.” (p.154)

**FIGURE 6 Factors that may influence the successful implementation of clinical information systems**

■ Management and clinical support and leadership – Failure of the implementers to engage with the users has been shown to contribute to poor acceptance of a system.
■ Identification of changes in work practices and workflow prior to system implementation and redesign of these.
■ Clinician work force with reasonable level of IT skills.
■ Sufficient implementation budget.
■ Alignment of electronic decision support system implementation with strategic direction of the hospital and electronic decision support systems viewed as a means to improved patient care.
■ Ongoing evaluation to assess affect, particularly any negative impact of system on quality of care indicators.
■ Dissemination and discussion of realistic benefits of electronic decision support systems.
■ Technical capability in terms of speed, reliability, user friendly.
■ Clinical involvement in the development of customisable components.
■ Training just-in-time.
■ Awareness of the risk of over-alerting.
■ Electronic decision support system recognised as part of overall organisational culture change.

He further argues that,

“..the most successful implementation processes appear to be those in which an obsession for control and planning is replaced by an obsession for experimentation and mutual learning.” (p.154)

This does not negate the relevance of factors such as high level support for the implementation process, and appropriate technology access and functionality, but places them within a broader context of bringing about substantial changes in the way clinicians do their work and health care organisations function.

Views from those involved in projects in our inventory indicate that there are a number of key factors that are identified across professions and areas. The benefits of electronic decision support systems should be to the quality and safety of patient care. Clinicians should be able to use the system easily and quickly. There should be adequate access to enable quick and easy use of the system. The system should be reliable and secure. User satisfaction was a broad factor, incorporating aspects of usability, accessibility, time and staff perceptions of benefits. Most also felt that the benefits would have to include improvements to clinical care, such as a reduction in medication errors and adverse events. The high level of use was also mentioned by managers, nursing and pathology staff.

Benefits measured should include user satisfaction, impact on patient care and for some, cost savings. The impact on patient satisfaction was perceived to be minimal or indirect. The impact on work practice was recognised by many, and was viewed in both positive and negative ways. The need for systems to be flexible and tailored across specialities was recognised. Many challenges result from the ‘monolithic’ software architecture of today’s healthcare information systems, which are still developed on the assumption that a single comprehensive system can best meet the needs of a healthcare organisation.

Other potential difficulties perceived by interview interviewees were security of the system and confidentiality of patient information. The reliability and robustness of the system was also raised by pathologists, managers and medics. Pathology services potentially handle thousands of orders a day and consequently they were most wary about the disintegration of the smooth running of their services. One manager talked about the need to build redundancy into the system to allow for problems. Clinicians discussed the duplication of records in paper and electronic form as being time consuming.

With the Commonwealth and states’ priorities firmly focused on using information technology as a tool to improve the quality of Australia’s health care, lack of financial support remains the major barrier to implementing and adopting health information technology. These are the findings from surveys conducted over the

past three years at the Health Informatics Society of Australia annual conferences (Table 13). These figures represent the views of senior health practitioners, clinicians, government representatives and information managers and emphasise the importance of the culture shift to be realised in the health sector as it has lagged behind most other industries in its uptake of information technologies.

Based upon this input, we have divided identified barriers into four broad categories according to whether they related primarily to characteristics of the electronic decision support system to be implemented, future electronic decision support system users, system implementation process, and the organisation or environment (Ashford et al. 1999; Foy et al. 2001).

**TABLE 13 Health Informatics Conference attendees' opinion (%) \***

	1999	2000	2001
<b>BARRIERS TO IT IMPLEMENTATION</b>			
Lack of financial support	12	12	15
Difficulty with end-user training	10	10	12
Lack of doctor acceptance	10	10	5
Lack of top management support	5	5	9
<b>CHANGE IN IT BUDGET OVER LAST 12 MONTHS</b>			
Definitely increased	24	24	14
Probably increased	34	34	24
Probably decreased	6	6	14
Definitely decreased	0	0	10

\* Source: Health Informatics Society of Australia Press Release, 31 July 2002.

## 6.2 Barriers related to characteristics of the electronic decision support systems

Electronic decision support systems validity, relevance and practicality have been seen as major obstacles to electronic decision support systems success in a healthcare (Table 14). Lack of system standardisation and compatibility are issues that should be addressed by electronic decision support systems designers and developers.

End-users challenge system cost-effectiveness and system knowledge bases which are often opinion-based and difficult to maintain. Some users have concerns that an electronic decision support system would increase consultation times (Carroll et al. 2002). Doctors argue that many systems are limited by a quality of the data entered

and do reflect local patient mix and practice patterns. There is also a possibility of the electronic decision support system misguiding users. For example, physicians usually incorporate sound advice in their decisions and ignore unhelpful advice, however, sometimes the reverse may occur. In one study, in 6 per cent of cases doctors changed from a correct to incorrect diagnosis after consultation with electronic decision support systems (Friedman, 1999).

### **6.3 Barriers related to characteristics of electronic decision support system users**

Evidence suggests that doctors are often reluctant to embrace information technology to support evidence-based clinical decision-making. For example, a survey of Australian general practitioners showed that out of 134 respondents who had access to the Internet 22 per cent were aware of the Cochrane library, although only 6 per cent had access to it and 4 per cent had ever used it (Young & Ward, 1999).

Characteristics of the individuals who need to change their behaviour before they use electronic decision support systems fell into the broad categories of knowledge, beliefs, attitudes and skills (Table 15) that are more likely to require interventions involving education, persuasion or training (Foy et al. 2001). Resistance to change and significant variations in practice patterns contribute to limited acceptance of evidence-based practice in general and electronic decision support system implementation in particular (Cabana et al. 1999; Mason et al. 2001). Doctors often express doubts whether electronic decision support systems are used to improve medical care but to control it (Monaghan, 1999). Furthermore, attitudes of health care professionals towards electronic decision support systems paradoxically combine inflated expectations and zero tolerance for failure (McAlister et al. 1999).

### **6.4 Barriers related to characteristics of electronic decision support system implementation**

Barriers related to electronic decision support system implementation processes are listed in Table 16. Many electronic decision support systems have fairly limited scope because each was created for a specific need/task. The average healthcare professional is uninterested in learning a different system for each type of a decision task faced. Furthermore, at this stage most available systems require manual patient data entry and the use of electronic decision support systems does not fit in naturally with the

practitioners' work style. Users' fear of legal liability and system incompatibility often contribute to the problem. Our limited ability to understand and predict the behaviour of electronic decision support systems and provide important knowledge to inform further developments are additional challenges (Guimaraes et al. 1992).

Clinicians are becoming increasingly involved in the development and procurement of electronic decision support systems in healthcare, yet implementation studies have provided little useful information to assist them. Implementation is often difficult because of our limited understanding of the role of electronic decision support systems in healthcare and our ability to deliver systems that offer a wide range of clinical and economic benefits (Heatherfield et al. 1998).

## **6.5 Barriers related to characteristics of the organisation and environment**

Barriers related to characteristics of the organisation and environment include established procedures and processes, resources and the culture of the organisation are documented in Table 17. The health care industry remains fragmented with poor IT infrastructure and practitioners largely relying on passive information dissemination (Schiff & Rucker, 1998). Many health care settings have not yet fully deployed such standard tools as local area networks, electronic mail, internet and other enabling technologies.

Significant culture change within health care organisations is required for electronic decision support systems to have an impact. Policy makers and healthcare managers have more power to address most of these barriers than do electronic decision support systems developers and evaluators. However, they can address the majority of barriers related to characteristics of electronic decision support systems itself.

There is still a need for a greater understanding of how successful electronic decision support systems work and for more evidence on the cost-effectiveness of tailoring electronic decision support system implementation protocols specifically to identified barriers.

**TABLE 14**      **Barriers related to characteristics of electronic decision support systems**

Barriers	Examples	References
<b>System validity</b>	<ol style="list-style-type: none"> <li>1. Opinion-based recommendations.</li> <li>2. Insufficient quality control in electronic decision support systems development.</li> <li>3. Unproven cost-effectiveness.</li> </ol>	<p>Eastwood et al. 1996 Smith et al. 2000 Smith, 1996</p>
<b>System relevance</b>	<ol style="list-style-type: none"> <li>1. Limited applicability of electronic decision support system output to clinical practice (eg, different patient mix).</li> <li>2. Uncertainty about the “shelf-life” of electronic decision support systems and currency of electronic decision support system output.</li> </ol>	<p>Mant, 1999 Smith et al. 2000 Cabana et al. 1999</p>
<b>System practicality</b>	<ol style="list-style-type: none"> <li>1. Ambiguous electronic decision support system output.</li> <li>2. Disruption to routine practice.</li> <li>3. Low up-take and clinical impact.</li> <li>4. Increase in consultation times.</li> </ol>	<p>Berg, 2001 Birkmeyer et al. 2000 Roessner, 2000</p>

**TABLE 15**      **Barriers related to electronic decision support system users**

Barriers	Examples	References
<b>Knowledge</b>	<ol style="list-style-type: none"> <li>1. Lack of awareness that clinical practice may be inappropriate.</li> <li>2. Overestimation of self-reported performance.</li> </ol>	<p>Bornstein et al. 2001 Iqbal, 1998</p>
<b>Attitudes and beliefs</b>	<ol style="list-style-type: none"> <li>1. General hostility to guidelines (“cook-book” medicine).</li> <li>2. Previous adverse experience of changing practice.</li> <li>3. Uncertainty about medico-legal implications of electronic decision support use (eg, increased susceptibility to litigation).</li> <li>4. Doubts about credibility of electronic decision support knowledge source.</li> <li>5. Low outcome expectations.</li> </ol>	<p>Slotnick, 2000 Senge, 1992 Buck et al. 1974 McAlister et al. 1999 Smith et al. 2000  Smith-Moore et al. 2000 Browman, 2000</p>
<b>Skills and abilities</b>	<ol style="list-style-type: none"> <li>1. Lack of IT skills.</li> <li>2. Over-reliance on ‘traditional’ sources of information.</li> <li>3. Belief that he cannot perform the task of electronic decision support system use.</li> </ol>	<p>Tierney et al. 1993 Beilby &amp; Silagy, 1997 Smith et al. 2000</p>
<b>Behaviour</b>	<ol style="list-style-type: none"> <li>1. Limited ability of high-speed information processing under pressure.</li> <li>2. Lack of time and resources to plan changes in practice.</li> </ol>	<p>Smith et al. 2000 Bornstein et al. 2001</p>

**TABLE 16 Barriers related to electronic decision support systems implementation process**

Barriers	Examples	References
<b>IT support</b>	1. Systems incompatibility 2. Lack of IT infrastructure	Smith et al. 2000 Shiff & Rucker, 1998 Cushman, 1997
<b>Poor targeting of problem areas</b>	1. Failure to prioritise implementation	Farbey et al. 1992 Dawson, 1997
<b>Insufficient system evaluation</b>	1. Lack of pre-implementation evaluation. 2. Lack of post-implementation evaluation.	Eisenberg, 1999 Eoyang & Berkas, 1999
<b>Medico-legal concerns</b>	1. No system for electronic decision support system accreditation.	Berg, 2001

**TABLE 17 Barriers related to characteristics of the organisation or decision environment**

Barriers	Examples	References
<b>Established practices and decision-making processes</b>	1. Over-reliance on passive methods of information support. 2. Electronic decision support system implementation without adaptation to local circumstances. 3. Inertia of larger organisations.	Freemantle et al. 1999 Heathfield et al. 1998 Greatbatch et al. 2001 Smith et al. 2000 Eisenberg, 1999
<b>Culture</b>	1. Little or no history of electronic decision support system use. 2. Negative attitudes of clinicians. 3. Resistance to change.	Farbey et al. 1992 McColl et al. 1998 Slotnick, 2000
<b>Resources</b>	1. Opportunity costs of changing performance. 2. Limited resources.	Gavand & Bates, 2000
<b>Knowledge of organisational performance</b>	1. Promotion of non-evidence-based medicine standards. 2. Negative attitude to clinical audit by clinicians and managers. 3. Poor quality of clinical audit. 4. Difficulty in measuring of outcomes. 5. Short-term outlook rather than appreciation of long-term nature of electronic decision support system impact and sustaining change.	Sheldon, 1998 McPeak, 1998 Eisenberg, 1999 Dunning et al. 1999 Roessner, 2000 Smith et al. 2000 Senge, 1992
<b>Patient factors</b>	1. Conflicting expectations and preference over choices in clinical management.	Eisenberg, 1999

**FIGURE 7. Challenges for electronic decision support system implementation and adoption in Australia identified in the inventory**

■ Lack of resources and limited IT infrastructure in health care (access to computers, network speed, lack of support staff etc).
■ Lack of end-user IT skills.
■ Lack of certainty for standards and protocols (eg, constant changes in Medicare items).
■ Resources and energy required for electronic decision support system implementation.
■ Challenges in large IT project management (diversity of stakeholders' issues, dependence on software vendors, quality and timeliness).
■ Lack of incentives to implement quality improvement activities.
■ Resistance to change (clinicians' resistance to audit).
■ Medico-legal issues.
■ Absence of accurate customer identification.
■ Lack of quality knowledge bases (eg, local evidence-based guidelines, information about drug interactions).

**FIGURE 8 Enablers for electronic decision support system implementation and adoption in Australia identified in the inventory**

■ End-user support and involvement: collaboration and partnership.
■ Incentives for electronic decision support system use (eg, Population Information Program).
■ Retaining clinicians involvement into further development.
■ Sufficient funding and Government support.
■ Successful marketing strategies and change management.
■ Continuous training.
■ Quality project planning.
■ Ability to integrate a electronic decision support system into existing information systems.
■ Implementation focussed on health care outcomes.
■ Market capacity to adopt accreditation standards.
■ Co-ordination of systems for future product development.
■ High quality content and knowledge sources.



**TABLE 18 Barriers to usage of electronic information systems identified by Australian General Practitioners**

Barriers		GPs' view* Frequency of response ( %)**
<b>Professional</b>	1. Cost and resourcing	45.6
	2. Time to learn	43.8
	3. Lack of IT skills	41.2
	4. Security and privacy concerns	6.1
	5. Lack of confidence in IT systems	4.4
<b>Technical</b>	6. Lack of IT support	35.9
	7. Too much choice	18.4
	8. System reliability	7.9
	9. Connection speed	2.6
<b>Personal</b>	10. Fear of new technology	27.2
	11. Resistance to change	10.5
	12. GPs near retirement	6.1
	13. Cannot see any advantage	3.5

\* Adapted from Stocktake/Needs Analysis: Information Management in General Practice. Australian Divisions of General Practice, 2002, p.5.

\*\*Total of 114 Australian Divisions of General Practitioners surveyed.

**Table 19 Barriers to usage of electronic information systems identified by electronic decision support inventory**

Barriers		Electronic decision support systems developers and implementers' view ( %)
<b>Professional</b>	1. Cost and resourcing	24.0
	2. Lack of IT skills	13.3
	3. Security and privacy concerns	2.8
<b>Technical</b>	4. Lack of IT support	10.0
	5. System reliability	2.8
	6. Connection speed	2.8
<b>Personal</b>	7. Fear of new technology	2.8
	8. Resistance to change	10.0

## 6.6 Summary

Main barriers for electronic decision support systems success cited by our project interviewees were lack of resources and end-user attitudes. Lack of resources was related to limited funding for proper evaluation, underdeveloped existing IT infrastructure in health care settings etc. Many respondents expressed concerns about lack of incentives for health care professionals to learn how to use and use electronic decision support systems in routine practice. Significant barriers and challenges for successful electronic decision support system implementation and use identified by our respondents are listed in the Figure 7.

Comparison of views about computerised decision support expressed by general practitioners and systems developers and evaluators shows some asymmetry in value placed on different barriers by these two major stakeholders. For example, decision support system project leaders indicated that lack of standard protocols and IT infrastructure are of most to them. Some acknowledged numerous difficulties associated with a large-scale IT implementation like diverse stakeholder base and agendas, dependence on a variety of software vendors, licensing arrangements etc. General practitioners were more concerned about electronic decision support system reliability and their security and privacy than were IT developers. The latter expressed dissatisfaction with physicians' reluctance to change working practices and the progress on electronic health records. Both groups commented on the poor quality of the knowledge contents available. It is impossible to make a valid comparison of these observations but it appears that top two barriers for electronic decision support systems adoption identified by two groups are the same: cost and lack of IT skills.

## 7 CHALLENGES TO ACCEPTANCE OF DECISION SUPPORT TECHNOLOGY AND BARRIERS TO BE ADDRESSED IN THE AUSTRALIAN CONTEXT

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### 7.1 Evaluation

About one quarter of the projects in the inventory attempted to evaluate their system in any rigorous or comprehensive manner. Most concentrated on user acceptability of the electronic decision support systems, rather than attempting to measure improvements to clinical processes or outcomes. There was widespread variation in the evaluation methods chosen, making comparison of the effectiveness of different systems very difficult. There appears to be no consistent attempt to re-use or extend standard evaluation methods. Consequently, the bulk of the investment in electronic decision support systems in Australia remains largely unevaluated, and it is not possible to make clear statements about costs and benefits in the absence of evaluation data.

Some projects indicated that evaluation did not occur because funding was not made available for this activity, indicating that evaluation is not a priority amongst funding bodies. Evaluation requires specialised skills, both for formative and summative assessments, and it is also likely that there is a significant skills shortage in this area.

#### **Likely benefits of a national coordinated approach to the development of electronic decision support systems**

Co-ordinating the approach to evaluation at a national level could significantly improve the current situation:

- a national body could assist in developing a set of benchmarks, or at least common methodologies, that permit comparison of the impact of systems in the clinical environment, and
- a national approach could also encourage the inclusion of evaluation as a core component of any electronic decision support activity.

## Recommendations

1. That evaluation be made a required component of any government funded electronic decision support programs, whether for research or operational systems, and that sufficient funds be made available to adequately resource such evaluation.
2. That evaluation guidelines be developed to ensure that when evaluations occur, they use rigorous and validated methods, and that their results are robust and permit across project comparisons. Adherence to these guidelines may be a condition for government-funded projects.
3. A national clearinghouse be set up to collect evaluation reports and enhance the dissemination of data about the efficiency and effectiveness of electronic decision support projects.

## 7.2 Quality and safety of system engineering

Adoption of software engineering standards is best practice in many sectors of the IT industry and in the medical devices sector, but this is not reflected in the electronic decision support systems in our survey. Amongst the systems in the inventory, only two reported the use of quality processes or quality testing to ensure that the electronic decision support systems performed correctly. Further, there was a lack of awareness of what such process standards might be. Consequently there appears to be a substantial gap in quality process in electronic decision support projects in Australia, raising the risk either that projects will fail because they are poorly managed, or they will perform unsafely or unreliably when fielded in clinical settings.

### Likely benefits of a national coordinated approach

The process of developing guidelines for electronic decision support systems development and testing is likely to be complex and technically demanding, and is unlikely to occur at anything other than a national level. Further, in line with the medical device industry, if certification of electronic decision support systems compliance with standards is contemplated, this too is only likely to occur at a national level.

## Recommendations

4. That government-funded projects be required to adopt best-practice standards in the development of electronic decision support systems.

5. That research be funded to report on the available standards for safety engineering of electronic decision support systems, noting that standards may vary between the different levels of decision support offered by a system, and the stage in a system's development from research prototype to operational system.
6. That consideration be given to the need for educational activities to inform government and industry of the critical importance of quality and safety standards in the design and ongoing support of electronic decision support systems.
7. That consideration be given to adopting an accreditation system for operational systems, checking for compliance with standards of best-practice in system engineering and ongoing maintenance.

## 7.3 Co-ordination of investments in electronic decision support systems

The projects contained in the inventory collectively represent an investment of over \$230 million. There are many projects identified in the inventory, but little co-ordination between most of them. Few projects were targeted at national priority areas for health. This suggests that there may be opportunities lost for sharing of experiences, or pooling of funds amongst projects with similar aims. It also suggests that there is no formal process of priority setting in the electronic decision support systems field, despite the larger investment occurring. Some notable positive examples of inter-State co-operation at a government level were identified. The Clinical Information Access Project from New South Wales Health has influenced the development of similar on-line evidence access systems in the other States. Two states, Victoria and Queensland, subsequently joined New South Wales in contractual agreements achieving significant economies of scale in purchasing clinical databases. A national Forum meets annually to share experiences with online evidence systems.

### Likely benefits of a national coordinated approach

While many electronic decision support systems projects will naturally be sponsored by State-based organisations, or industry, a large proportion of current funds are derived Federally. These funds were co-ordinated, there appears to be a substantial opportunity to prevent duplication of effort, sharing of experience and expertise, and refocussing on core priority areas.

## Recommendations

8. National priorities in electronic decision support research and investment be set, with reference both to national health priorities, as well as the need to develop the research and skill base in electronic decision support needed to service the large demand for such systems.
9. A national mechanism be developed to support co-operation between electronic decision support project teams. The aims would be to assist individual funding agencies to find partners in their electronic decision support projects and to ensure new projects build on past projects by identifying similar previous projects. The electronic decision support clearinghouse may be the basis of such a mechanism.
10. An annual electronic decision support Forum or Conference be sponsored to encourage interaction amongst stakeholders, share experiences, and contribute to the building of networks between government, academia and industry.
11. Consideration be given to developing mechanisms for large scale projects like Better Medication Management System to, where possible, partner with smaller projects which may be able to re-use infrastructure, assist in skill development, and exploit the expertise concentrated in the larger projects.

## 7.4 Role of industry

Government is the driver of the Australian electronic decision support sector. Over two thirds of projects were funded predominantly by government. A small number of projects accounted for the bulk of the investment, and typically these are funded Federally, for example the Better Medication Management System. Amongst the projects reported in the inventory as being ‘in progress’, 14 were government funded and four were industry supported.

Industry routinely reports that, on the occasions when it is asked to undertake electronic decision support projects, it does not have spare capacity to undertake such projects, because of the intermittent nature of funding and the difficulty in retaining staff during lean times. The fragmented nature of the medical software industry also means that there is little capacity to undertake research and development in-house. Yet electronic decision support systems at Type Two and upwards require the use of knowledge-based technologies, which are still not widespread in the IT industry and would require some research and development capacity for many software houses to be in a position to develop them.

## Likely benefits of a national coordinated approach

The healthcare IT industry is still relatively fragmented and many software houses are small. Encouraging industry to collaborate internally, as well as with academic and government-based agencies, may result in a more co-ordinated and cost-effective approach to the development of electronic decision support systems, with many players sharing the risk and resources needed to undertake research and development. Such activities may also assist in fostering a new electronic decision support systems industry in Australia that is internationally competitive.

## Recommendations

12. Consideration be given to a program modelled upon the Australian Research Council's linkage program, which encourages collaborative projects between academia and industry, and results in the transfer of new technologies into operational settings, as well as contributes to enhancing the capacity of industry to undertake research and development.

## 7.5 Capacity development and electronic decision support research

As already indicated, the projects contained in the inventory collectively represent a considerable investment of over \$230 million. Paradoxically the electronic decision support community in Australia seems small, as indeed is the wider health informatics community from which it is drawn. Few projects indicated that the results of their projects would be written up in the literature, and the failure for most to address evaluation indicates a lack of research culture. As a result few robust lessons can be drawn from most projects. There appears to be a large gap between the increasing demand for the design, evaluation and implementation of electronic decision support systems and the available national skill base to meet this demand. Finally, despite the fact that much of the variation in uptake of information technology in healthcare can be attributed to socio-technical issues such as organisational culture, little attention to such issues are revealed in our project inventory.

## Likely benefits of a national coordinated approach

The small pool of experienced health IT and health informatics professionals available suggests that a State-based approach is unlikely to be sustainable, and that capacity building is a national priority. The creation of a trained and experienced pool of such

individuals nationally should result in a reduction in the risk associated with implementing electronic decision support projects, an improvement in the quality and impact of such systems when deployed, and may assist in fostering a new industry in Australia that is internationally competitive.

## Recommendations

- 13.** The development of national capacity in electronic decision support systems be supported by the provision of specific funds to support research in the design and evaluation of electronic decision support systems in clinical settings, for example by identifying specific panels within the National Health and Medical Research Council, the Australian Research Council or the National Health Information Management Advisory Council. As part of that strategy it may be appropriate to identify infrastructure funds over several years, to support the development of one, or several, centres of excellence in electronic decision support systems research.
- 14.** The development of national capacity in electronic decision support be supported by the provision of specific funds to support education and professional development at a postgraduate level. This could come via the creation of local, international and industry training Fellowships. It could also be supported by provision of seed funds to encourage the development of courses, which would presumably be self-funding once past their start-up phase.
- 15.** Consideration be given to set up a register of professional experts in key areas who may be available to provide consultancy regarding electronic decision support systems development and evaluation. This could be incorporated into the clearing-house database.
- 16.** Encourage research into the broad range of issues needed to understand how systems are to be integrated successfully into healthcare settings and to maximise the impact of such technologies, with encouragement of socio-technical studies.



## 8 SUMMARY RECOMMENDATIONS

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### 8.1 Quality system evaluation

1. That evaluation be made a required component of any government funded electronic decision support programs, whether for research or operational systems, and that sufficient funds be made available to adequately resource such evaluation.
2. That evaluation guidelines be developed to ensure that when evaluations occur they use rigorous and validated methods, and that their results are robust and permit across project comparisons. Adherence to these guidelines may be a condition for government-funded projects.
3. A national clearinghouse be set up to collect evaluation reports and enhance the dissemination of data about the efficiency and effectiveness of electronic decision support projects.

### 8.2 Quality and safety of system engineering

4. That research be funded to report on the available standards for safety engineering of electronic decision support systems, noting that standards may vary between the different levels of decision support offered by a system, and the stage in a system's development from research prototype to operational system.
5. That government-funded projects be required to adopt best-practice standards in the development of electronic decision support systems.
6. That consideration be given to adopting an accreditation system for operational systems, checking for compliance with standards of best-practice in system engineering and ongoing maintenance.
7. That consideration be given to the need for educational activities to inform government and industry of the critical importance of quality and safety standards in the design and ongoing support of electronic decision support systems.

### **8.3 Co-ordination of investments in electronic decision support systems**

- 8.** National priorities in electronic decision support research and investment be set, with reference both to national health priorities, as well as the need to develop the research and skill base in electronic decision support to ensure adequate national capacity is available to service the large demand for such systems.
- 9.** A national mechanism be developed to support co-operation between electronic decision support project teams. The aims would be to assist individual funding agencies to find partners in their electronic decision support projects and to ensure new projects built on past projects by identifying and providing details of similar previous projects. The electronic decision support clearinghouse may be the basis of such a mechanism.
- 10.** An annual electronic decision support forum or conference be sponsored to encourage interaction amongst stakeholders, share experiences, and contribute to the building of networks between government, academia and industry.
- 11.** Consideration be given to developing mechanisms for large scale projects like the Better Medication Management System to, where possible, also partner with smaller projects which may be able to re-use infrastructure, assist in skill development, and exploit the expertise concentrated in the larger projects.

### **8.4 Role of industry**

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16. Encourage research into the broad range of issues needed to understand how systems are to be integrated successfully into healthcare settings and to maximise the impact of such technologies, with encouragement of socio-technical studies.

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# Attachments

# ATTACHMENT A. INVENTORY TEMPLATE

## Demographic Data

Organisation name
Contact Name
Contact Details
Website address
Sponsor/Partner organisation(s)

## System data

Title of Project	
Type of Project	Research/Commercial
Description of Project	
Setting of the Project	Primary Care/Hospital/Community Pharmacy/ Hospital Pharmacy/Pathology/Radiology/ Specialist Rooms/Community Care
Location of the Project	States and Territories
Project audience/User base	<10 users/10-100 users/>100 users
Frequency of EDSS use	
Year project commenced	
Project status	In progress/completed
Project duration (if in progress)	
Principal funding source	
Type of funding	Public/Private/Mixture/Self-funded
Project budget (if disclosed)	
System characteristics	
Year commissioned	
Type of support	Type 1/Type 2/Type 3/Type 4
Function (more than one allowed)	Info Retrieval/ Alerts & Reminders/Critiquing/ Diagnosis/Therapy planning & management/ Clinical audit
System availability	Public/Proprietary
Consumer information	Yes/No
Knowledge source	In-house/Commercial database/ Published data
Names of knowledge sources	



## Standards

Mark-up	None/HTML/XML/DSML/Arden Syntax/Other
Security	None/PKI/Other
Coding	None/ICD/SNOMED/UMLS/Other
Messaging	None/HL-7/MEDIX/NCPDP/Other
Imaging	None/DICOM/Other
Hardware	
Software	

## References

## System evaluation data

Evaluation methodology	Not done/Qualitative/Before/after sample/ Case study/ Case-control/RCT
Evaluation team	Internal/External
Consumer input in design	Yes/No
Impact on process measures	
Confidence in decision	Not measured/Yes/No
Adverse effects/errors	Not measured/Yes/No
Adherence to protocol	Not measured/Yes/No
Pattern of care	Not measured/Yes/No
Efficiency/Cost	Not measured/Yes/No
Quality of care	Not measured/Yes/No
Others	
Impact on patient outcomes	
Morbidity	Not measured/Yes/No
Mortality	Not measured/Yes/No
Barriers to success	
Enablers for success	

# ATTACHMENT B. REFERENCES TEMPLATE

## Demographic Data

Organisation name
First author
Contact Details
Publication reference

## System data

Title of Project	
Type of Project	Research/Commercial
Description of Project	
Setting of the Project	Primary Care/Hospital/Community Pharmacy/ Hospital Pharmacy/Pathology/Radiology/ Specialist Rooms/Community Care
Location of the Project	States and Territories
Project audience/User base	<10 users/10-100 users/>100 users
Frequency of electronic decision support system use	
Year project commenced	
Project status	In progress/completed
Project duration (if in progress)	
Principal funding source	
Type of funding	Public/Private/Mixture/Self-funded
Project budget (if disclosed)	

System characteristics	
Year commissioned	
Type of support	Type 1/Type 2/Type 3/Type 4
Function (more than one allowed)	Info Retrieval/ Alerts & Reminders/Critiquing/ Diagnosis/Therapy planning & management/ Clinical audit
System availability	Public/Proprietary
Consumer information	Yes/No
Knowledge source	In-house/Commercial database/ Published data
Names of knowledge sources	
Standards	
Mark-up	None/HTML/XML/DSML/Arden Syntax/Other
Security	None/PKI/Other
Coding	None/ICD/SNOMED/UMLS/Other
Messaging	None/HL-7/MEDIX/NCPDP/Other
Imaging	None/DICOM/Other
Hardware	
Software	
References	

## System evaluation data

Evaluation methodology	Not done/Qualitative/Before/after sample/ Case study/ Case-control/RCT
Evaluation team	Internal/External
Consumer input in design	Yes/No
Impact on process measures	
Confidence in decision	Not measured/Yes/No
Adverse effects/errors	Not measured/Yes/No
Adherence to protocol	Not measured/Yes/No
Pattern of care	Not measured/Yes/No
Efficiency/Cost	Not measured/Yes/No
Quality of care	Not measured/Yes/No
Others	
Impact on patient outcomes	
Morbidity	Not measured/Yes/No
Mortality	Not measured/Yes/No
Barriers to success	
Enablers for success	

# ATTACHMENT C. INVENTORY CONTACT LIST

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ACT Dept of Health and Community Care  
Adelaide Plastic Surgery Associates  
Alliance of NSW Divisions  
Australian Association of Consultant Pharmacy  
Australian College of HealthCare Executives, and PriceWaterhouseCoopers  
Australian Divisions of General Practice  
Australian Medical Association  
Barwon Division of General Practice  
Blackmores Ltd – R&D  
Blue Mountains Division of General Practice  
Brisbane North Division of General Practice  
Canning Division of General Practice  
Cardinal HealthCare  
Central Coast Division of General Practice  
Collaborative Centre for e Health  
Collaborative Health Informatics Centre – ceased activity June 2002  
Department of Health and Ageing  
Department of Health and Ageing, HealthInsite  
Department of Health and Ageing, Better Medication Management System  
Department of Health and Ageing, Clinician's Health Channel  
Department of Health and Ageing, Electronic Red Book  
Department of Health and Ageing, Call Centres (HealthFirst, HealthDirect)  
Department of Human Services, South Australia  
Department of Health and Human Services, Tasmania  
Department of Human Services, Clinicians Health Channel Project, Acute Health Division (Victoria)  
Diabetes Australia  
DMR Consulting, Asia Pacific  
Drug and Therapeutics Information Service  
East Clinic Ipswich Division of General Practice  
eClinic Pty Ltd  
eHealth Australia  
Enigma Publishing

General Practice Computing Group  
Goldfields Women's Health Care Clinic  
Johnson & Johnson Medical  
Hatrix Pty Ltd  
Health Communications Network  
Health Informatics  
Health Insurance Commission  
HealthLink Limited  
HealthSolve Pty Ltd  
High Performance Software  
Horsby Ku-ring-gai Ryde Division of General Practice  
Hunter Rural Division of GP  
Hospital Pharmacy Services  
IBA Health Ltd  
IBA Technologies Ltd  
IBM – Health Networks  
iSOFT  
JAM Software  
Kestral Computing  
Kimberley Division of General Practice  
KPMG – Information  
La Trobe University – School of Public Health  
MacArthur Division of General Practice  
MacArthur Division of General Practice & GP Health Informatics  
Mastech Asia Pacific  
Mayne Health  
Mayne IT  
MedCare Systems  
Medical Software Industry Association  
Medical Spectrum Pty Ltd  
Medilink  
MedNetwork Systems  
MedSeed  
MedTech Healthcare Pty Ltd  
Merck Sharp & Dohme Australia  
Michael Legg & Associates  
MicroMedex

Monash University – Centre for Medical Informatics  
Muse Solutions  
National Prescribing Services  
North West Melbourne Division of General Practice  
Northern Territory Health Services – Business Information Management  
NSW Health Department  
Ozdocsonline  
Pacific Knowledge Systems  
PECC Project  
Pen Computer Systems  
Peter MacCallum Cancer Institute  
Pharmacy Guild of Australia  
PharmaSol Pty Ltd  
Pharmacy Computers Australia Pty Ltd  
Phoenix Computer Systems  
Pro Medicus Pty Ltd  
Quality Use of Pathology Committee  
Queensland Health  
Royal College of Pathologists of Australasia, Pathology Informatics Working Party  
SA Centre for Rural & Remote Health, University of Adelaide  
SA Divisions of General Practice  
SeeBeyond  
Southern Cross University  
South East NSW Division of GP  
St George Division of General Practice Inc  
Sutherland Division of General Practice Inc  
Telecommunications & Industrial Physics  
The Pharmaceutical Alliance  
Therapeutic Guidelines  
Therapeutic Goods Administration – ADR Unit  
TrakHealth Pty Ltd  
University of Adelaide  
University of Adelaide – Health Informatics  
University of Melbourne – Department of General Practice  
University of Newcastle  
University of Queensland – Centre for Online Health  
University of South Australia

University of Tasmania  
UNSW – School of Psychiatry  
UNSW – Centre for Health Informatics  
University of Wollongong, School of Information Technology  
Victoria Department of Human Services  
Western Sydney Division of General Practice  
Northern Territory Department of Health

# ATTACHMENT D. ELECTRONIC DECISION SUPPORT ACTIVITIES IN AUSTRALIA INVENTORY

## 1 Centre for Health Informatics, UNSW

CONTACT:	Professor Enrico Coiera
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WEBSITE:	<a href="http://www.chi.unsw.edu.au">http://www.chi.unsw.edu.au</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Quick Clinical	TYPE:	Research
SETTING:	Primary Care	STATUS:	In progress
LOCATION:	NSW	COMMENCED:	2001
USER BASE:	>100 users	DURATION:	1–3 years
FREQUENCY OF USE:	During consultations		
BUDGET:	\$1,600,000.00	FUNDING:	Mixture
PRINCIPAL FUNDING SOURCE:	ARC Spirt Grant and Merck Sharpe and Dohme		

### Description

The Quick Clinical project is developing an experimental on-line information retrieval system for use in the clinical setting.

Quick Clinical is designed around the specific information needs that arise within the clinical context of general practice and is designed to operate under the resource constraints of clinical work.



## System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:	Therapeutic G/lines, PUBMED, Health Insite, Medline Plus, Harrisons O/line MIMS		
COMMISSIONED:	2002		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:			

## System standards

MARKUP:	XML	SECURITY:	Other
CODING:	None	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	UML/IEEE/SEL 3

## System evaluation

TEAM:	Internal		
METHODOLOGY:	Before/after sample		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Yes	
	Pattern of care:	Yes	
	Adverse effects/errors:	Yes	
	Efficiency/cost:	Yes	
	Adherence to protocol:	Yes	
	Quality of care:	Yes	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured	
	Mortality:	Not measured	
BARRIERS TO SUCCESS:	GPs not having personal computers, and computer illiteracy		
ENABLERS TO SUCCESS:	GP support		

## Other comments

SECURITY:	SSL
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## 2 Collaborative Centre for eHealth

CONTACT:	Chris Lynton-Moll c/-Ross Davey
ADDRESS:	Collaborative Centre for eHealth Suite 15 Greenhill Enterprise Centre University Drive Mt Helen Victoria 3350
PHONE:	03 5327 9896
FAX:	03 5327 9307
EMAIL:	c.lynton-moll@ballarat.edu.au
WEB SITE:	<a href="http://www.ahml.com.au/">http://www.ahml.com.au/</a>
SPONSOR/PARTNER ORGANISATIONS	

### Project details

TITLE:	West VIC Division of General Practice Imaging Project	TYPE:	Research
SETTING:	Primary Care	STATUS:	Pilot study
LOCATION:	West Victoria	COMMENCED:	2002
USER BASE:	< 10 users	DURATION:	1-3 years
FREQUENCY OF USE:	Multiple use per day		
BUDGET:	\$500,000.00	FUNDING:	Public
PRINCIPAL FUNDING			
SOURCE:	Government Funded – Commonwealth Department of Health and Ageing		

### Description

- To provide GPs timely and appropriate access to diagnostic imaging guidelines.
- To improve consumer knowledge and understanding around medical imaging.
- To improve patient management of referrals in medical imaging departments.
- To promote best practice in diagnostic imaging to rural client health professionals.
- Using a secure e-mail system for the referrals and reports. Developing and designing an electronic decision support system.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:			
COMMISSIONED:	2001		
SYSTEM AVAILABILITY:	Public		
REFERENCES:	N/A		

## System standards

MARKUP:	DSML	SECURITY:	PKI
CODING:	Other	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:	N/A	SOFTWARE:	N/A

## System evaluation

TEAM:	Combination		
METHODOLOGY:	Qualitative		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:		
	Pattern of care:		
	Adverse effects/errors:		
	Efficiency/cost:		
	Adherence to protocol:		
	Quality of care:		
IMPACT ON PATIENT OUTCOMES:	Morbidity:		
	Mortality:		
BARRIERS TO SUCCESS:	N/A		
ENABLERS TO SUCCESS:	N/A		

## Other comments

MARKUP:	XML
CODING:	Loinc
PROCESS MEASURES:	yet to be evaluated

### 3 Department of Health and Ageing

CONTACT:	Helen Briggs
ADDRESS:	Department of Health and Ageing GPO Box 9848, Canberra ACT 2601
PHONE:	1800 020 103
FAX:	02 6281 6946
EMAIL:	helen.briggs@health.gov.au
WEBSITE:	<a href="http://www.health.gov.au/bmms/index">http://www.health.gov.au/bmms/index</a>
SPONSOR/PARTNER ORGANISATIONS:	Health Insurance Commission (HIC); other partners include Ministerially appointed BMMS Development Group (representing stakeholders)

#### Project details

TITLE:	BMMS – Field Test	TYPE:	Research
SETTING:	Multiple healthcare	STATUS:	In progress
LOCATION:	to be advised	COMMENCED:	April 2003
USER BASE:	>100users	DURATION:	1–3 years
FREQUENCY OF USE: In testing phase: to be evaluated			
BUDGET:	Announced in May 2002 as \$134M over 4 years (initial phases, budgeted annually)		
FUNDING:	Public		
PRINCIPAL FUNDING SOURCE:	Commonwealth Department of Health and Ageing		

#### Description

BMMS Field Test Phase 1 is a limited field test of functionality (limited numbers of Doctors, consumers & pharmacies) to test electronic communications system functionality. Location yet to be specified.

Example of functionality testing is: use of PKI; time taken to recall record from central HIC repository.

Phase 2 focus on implementation and evaluation of usefulness to each sectors participants and impact on business processes. Phase 2 includes access to Hospital-Emergency Care records.

#### System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	

NAMES:	BMMS to interact with other systems for drug interactions and alerts etc
COMMISSIONED:	2001
SYSTEM AVAILABILITY:	Public
REFERENCES:	Acceptance testing to be conducted by HIC Evaluation Working Group established for Field Tests

## System standards

MARKUP:		SECURITY:	PKI
CODING:	other – EAN	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:		SOFTWARE:	Dependent on developers

## System evaluation

TEAM:	Combination
METHODOLOGY:	Before/After sample
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Not measured
	Pattern of care: Yes (phase 1)
	Adverse effects/errors: Not measured
	Efficiency/cost: Not measured
	Adherence to protocol: Not measured
	Quality of care: Yes (phase 1)
IMPACT ON PATIENT OUTCOMES:	Morbidity: Not measured
	Mortality: Not measured
BARRIERS TO SUCCESS:	Large project; diverse stakeholder issues; design issues of scale of project/size; dependence on software vendors re: quality and timeliness; legal issues re: privacy, security, lack of legislation specific to BMMS.
ENABLERS TO SUCCESS:	Consumers use of the BMMS medication record; collaboration and partnership; hardware and software capacity (eg bandwidth); Issues of governance etc to be resolved for this project with interoperability in future.

## Other comments

Field test is – Proof of Concept for proving technical functionality (Phase 1) which is communicated to end-users (Phase 2) with measurement of BMMS impact on business processes (GPs', Pharmacists) and consumer usefulness.

## 4 Department of Health and Ageing, HealthInsite

CONTACT:	Jill Buckley Smith
ADDRESS:	HealthInsite Editorial Team Evidence Based Strategies Section Department of Health and Ageing, MDP 23 GPO Box 9848, Canberra ACT 2601
PHONE:	02 6289-8488
FAX:	02 6289 5870
EMAIL:	jill.smith@health.gov.au
WEB SITE:	<a href="http://www.healthinsite.gov.au/index.c">http://www.healthinsite.gov.au/index.c</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	HealthInsite	TYPE:	Other – consumer
SETTING:	Other – all	STATUS:	In progress
LOCATION:	Australia (national)	COMMENCED:	April 2002
USER BASE:	>100 users	DURATION:	> 5 years
FREQUENCY OF USE:	Over 1000 unique users per day		
BUDGET:	\$6.6M over 4 years	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Department of Health & Ageing		

### Description

HealthInsite is an Internet site that is designed to make it easy for Australian consumers to find quality health information on-line. It is a gateway site linking information from multiple content providers (including DHA site, and non-government sites and State Government sites). Links to information about health issues, conditions & diseases with life-stages and events that impact on people's health. Links only electronic sources i.e., information partners sites. Commissioned 5th May 1998.

### System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input checked="" type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	Website publications of partner organisations		

COMMISSIONED:	502
SYSTEM AVAILABILITY:	Public
REFERENCES:	Original budget announcement; original system specifications, ongoing system development and planning of new requirements (e.g., new content management system currently being implemented) Health & Aged Care Thesaurus (based on MESH) used for Coding.

## System standards

MARKUP:	HTML	SECURITY:	Other – User ID
CODING:	MESH	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	W3C, Dept of Health and Ageing Systems Standard

## System evaluation

TEAM:	Combination	
METHODOLOGY:	Qualitative	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Not measured
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Not measured
	Adherence to protocol:	No
	Quality of care:	Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS: Sufficient breadth and depth of information available; balancing availability of information against quality requirements; getting information partners with content that meets client needs; partners capacity to meet HealthInsite standards.		
ENABLERS TO SUCCESS: Commitment of information partners to high-quality info; support from Dept to provide service (\$\$, infrastructure etc); Health Online commencement after HealthInsite supports e-provision of health information.		

## Other comments

Information presented to users from a variety of sources, allows choices from quality sites but does not rank quality of content. Consumer input: focus testing, user feedback, editorial board representation, CHF evaluation.

## 5 Department of Health and Ageing

CONTACT:	Paul McGlew
Address:	Department of Health and Ageing, GPO Box 9848, Canberra ACT 2601
PHONE:	02 6289 8647
FAX:	02 6281 6946
EMAIL:	paul.mcglew@health.gov.au
WEB SITE:	http://www.health.gov.au
SPONSOR/ PARTNER ORGANISATIONS:	In process of building (July 02) but to include GP Computing Group; software industry; National Prescribing Service; National Institute of Clinical Studies; other Branches & Divisions in Commonwealth Govt (e.g., GP Branch, Diagnostics & Technology Branch).

### Project details

TITLE:	GP Electronic Decision Support	TYPE:	Other – public
SETTING:	Primary Care	STATUS:	In progress
LOCATION:	National	COMMENCED:	Feb 2003
USER BASE:	>100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Costing info accessed continuously		
BUDGET:	\$52M over 4 years	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Department of Health and Ageing		

### Description

Two parts: Information to GPs on prices of drugs and cost of referrals; + medical evidence delivery to GPs as part of the consultation process with patients. Two components planned to provide a prompt to GPs at point of decision making (eg prescribing) and to aid in diagnosis and treatment (eg on-line guidelines). Planned rollout to all GP practices Nationally, commissioned via May 2002 budget as part of the Practice Incentives Program (PIP) further development. Initial project 12 months followed by part 2 implementation over – 2 years to July 2004.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input checked="" type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Consumer information	



NAMES:	Depends on Industry partners to use
COMMISSIONED:	502
SYSTEM AVAILABILITY:	Public
References:	<p><b>Noted new project for implementation in 2003</b> Electronic Decision Support tools to be built into all GP software up to Level 3 capabilities, not owned by Govt but available to all GPs.</p> <p>Links between system participants for e-communication to be developed (? HL7). Development of standards &amp; compliance process yet to be initiated. Incentives for GPs to be developed with industry (? GPCG etc) to develop clear stds for hardware.</p>

## System standards

MARKUP:	None	SECURITY:	PKI
CODING:	TBA	MESSAGING:	None
IMAGING:	None		
HARDWARE:	TBA	SOFTWARE:	TBA

## System evaluation

TEAM:	Combination												
METHODOLOGY:	Case study												
CONSUMER INPUT IN DESIGN:													
IMPACT ON PROCESS MEASURES:	<table> <tr> <td>Confidence in decision:</td><td>Not measured</td></tr> <tr> <td>Pattern of care:</td><td>Not measured</td></tr> <tr> <td>Adverse effects/errors:</td><td>Not measured</td></tr> <tr> <td>Efficiency/cost:</td><td>Yes</td></tr> <tr> <td>Adherence to protocol:</td><td>Not measured</td></tr> <tr> <td>Quality of care:</td><td>Yes</td></tr> </table>	Confidence in decision:	Not measured	Pattern of care:	Not measured	Adverse effects/errors:	Not measured	Efficiency/cost:	Yes	Adherence to protocol:	Not measured	Quality of care:	Yes
Confidence in decision:	Not measured												
Pattern of care:	Not measured												
Adverse effects/errors:	Not measured												
Efficiency/cost:	Yes												
Adherence to protocol:	Not measured												
Quality of care:	Yes												
IMPACT ON PATIENT OUTCOMES:	<table> <tr> <td>Morbidity:</td><td>Not measured</td></tr> <tr> <td>Mortality:</td><td>Not measured</td></tr> </table>	Morbidity:	Not measured	Mortality:	Not measured								
Morbidity:	Not measured												
Mortality:	Not measured												
BARRIERS TO SUCCESS:	Access to knowledge base (eg, Aust Therapeutic Guidelines vs Medical Director licensing before GP use); lack of certainty for standards and protocols of GP practice; GP acceptance and resistance to take-up; and capacity.												
ENABLERS TO SUCCESS:	Identification of funds incentives for GPs; market capacity to adopt accreditation standards; adequate funding; high interest level environment (C'wlth, State & Primary Care sectors); and GP champions.												

## Other comments

Issues around evaluation processes are yet to be defined for Government 'strategic' development. Some capacity exists within the project for change eg funding and operational flexibility.

## 6 Department of Health and Human Services, Tasmania

CONTACT:	Paul Targett
ADDRESS:	Director of Corporate Services, Department of Health and Human Services 12 Murray Street, Hobart Tasmania 7000
PHONE:	1800 067 415
FAX:	
EMAIL:	paul.targett@dhhs.tas.gov.au
WEB SITE:	http://www.dhhs.tas.gov.au/
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	HealthConnect Trial in Tasmania	TYPE:	Research
SETTING:	Hospital & Community	STATUS:	In progress
LOCATION:	Tas	COMMENCED:	July 2002
USER BASE:	10–100 users	DURATION:	6–12 months
FREQUENCY OF USE:	Variable by end user		
BUDGET:	\$1,800,000.00 Commonwealth – \$1.4M Tas Govt– \$0.4 M approx	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Commonwealth		

### Description

Proof of Concept trial for diabetes patients and linkage of Public Hospitals to GPs for sharing common information on patient's clinical condition. Provides a range of information on the clinical condition of patients but not assessment.

Patients may visit a range of locations for health services (eg Clarence Clinical Centre or Tasmania Hospital) with patient information accessible at each. Tasmania is only implementing a selected trial with targeted group to assess the component in the large National HealthConnect project.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input checked="" type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input checked="" type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	Data from Dept Emergency Medicine systems, GP systems etc.		

COMMISSIONED:	
SYSTEM AVAILABILITY:	Public
REFERENCES:	Part of Commonwealth HealthConnect project

## System standards

MARKUP:	Other	SECURITY:	PKI
CODING:		MESSAGING:	
IMAGING:			
HARDWARE:		SOFTWARE:	

## System evaluation

TEAM:	Combination
METHODOLOGY:	Other – Feasibility Project
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Not measured
	Pattern of care: Yes
	Adverse effects/errors: Not measured
	Efficiency/cost: Yes
	Adherence to protocol: Yes
	Quality of care: Yes
IMPACT ON PATIENT OUTCOMES:	Morbidity: No
	Mortality: No
BARRIERS TO SUCCESS:	Getting buy-in of participants (GPs, patients); system development complexity (scale not an issue); legal issues of privacy etc; and compliance.
ENABLERS TO SUCCESS:	Financial support; high degree of participation interest; focused and controlled trial (Tasmania); clinically focused on a particular disease condition (diabetes).

## Other comments

Interviewee believes the Commonwealth requires too tight a timeframe for overall project which requires local compression of components for preparation of systems, design architecture, briefing and documentation of system requirements.

## 7 eClinic Pty Ltd

CONTACT:	Gavan Lim-Joon
ADDRESS:	eClinic Pty Ltd 657 Nicholson Street Carlton North VIC 3054
PHONE:	03 9381 4567
FAX:	03 9381 4657
EMAIL:	<a href="mailto:gavan@ecclinic.com.au">gavan@ecclinic.com.au</a>
WEB SITE:	<a href="http://www.ecclinic.com.au">http://www.ecclinic.com.au</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Secure Pathology Results Delivery	TYPE:	Commercial
SETTING:	Primary Care	STATUS:	In progress
LOCATION:	National	COMMENCED:	2001
USER BASE:	>100 users	DURATION:	>5 years
FREQUENCY OF USE:	multiple times per day		
BUDGET:	\$0.00	FUNDING:	Self Funded
PRINCIPAL FUNDING SOURCE:			

### Description

Delivering pathology/radiology results from pathology/radiology labs to private practice (GP's) securely over the Internet. Results are delivered either via the web (secure login and PKI), or via an installed Windows client. Both encrypt/decrypt results with PKI (Public Key Infrastructure) i.e. Digital certificates supplied by either eSign or Hesa.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input checked="" type="checkbox"/> Diagnosis	<input type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:			
COMMISSIONED:	2001		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Refer to Gribbles website: <a href="http://www.gribbles.com.au">www.gribbles.com.au</a>		

## System standards

MARKUP:	Other	SECURITY:	PKI
CODING:	Other	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:	N/A	SOFTWARE:	HL7 compliant (AS4700.2)

## System evaluation

TEAM:	Internal	
METHODOLOGY:	Case study	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Yes
	Pattern of care:	Yes
	Adverse effects/errors:	Yes
	Efficiency/cost:	Yes
	Adherence to protocol:	No
	Quality of care:	Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS:	Clinical assess to the Internet	
ENABLERS TO SUCCESS:	Practice Improvement Program (PIP) – incentive to take up use of PC and the Internet.	

## Other comments

MARKUP:	HL7
CODING:	HL7

## 8 Hatrix Pty Ltd

CONTACT:	John Ainge
ADDRESS:	Hatrix Pty Ltd 45a Colbee Court Phillip ACT 2606
PHONE:	02 6282 8511
FAX:	02 6282 8522
EMAIL:	john.ainge@hatrix.com
WEB SITE:	<a href="http://www.hatrix.com/">http://www.hatrix.com/</a>
SPONSOR/ PARTNER ORGANISATIONS:	University of NSW, University of Newcastle, University of Otago.

### Project details

TITLE:	Electronic Medication Chart Project	TYPE:	Other
SETTING:	Hospital	STATUS:	In progress
LOCATION:	NSW	COMMENCED:	2002
USER BASE:	>100 users	DURATION:	6–12 months
FREQUENCY OF USE:	Every time prescribing decision is made		
BUDGET:	\$700,000.00	FUNDING:	Self funded
PRINCIPAL FUNDING SOURCE:			

### Description

Electronic Medication Chart delivers point of care, decision support services to clinical staff involved in prescribing in a hospital environment.

The system is XML based and developed by Hatrix to fully accommodate generic prescribing and requirements of the Australian Hospital environment. It allows gathering of data on impact of a system on the quality and cost of patient care.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input checked="" type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:	MIMS and AMH		
COMMISSIONED:			
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	None		

## System standards

MARKUP:	XML	SECURITY:	None
CODING:	ICD	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:	Microsoft System Standards	SOFTWARE:	Microsoft System Standards

## System evaluation

TEAM:	External
METHODOLOGY:	Before/after sample
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision:
	Pattern of care:
	Adverse effects/errors:
	Efficiency/cost:
	Adherence to protocol:
	Quality of care:
IMPACT ON PATIENT OUTCOMES:	Morbidity:
	Mortality:
BARRIERS TO SUCCESS:	Withdrawal of funding from AusIndustry
ENABLERS TO SUCCESS:	Collaborative development process

## Other comments

TYPE:	Research and commercial
EVALUATION:	Currently in progress
LEVEL OF SUPPORT:	Primary level 2 however includes components of level 3

## 9 Health Communications Network

CONTACT:	Dianne Gerlach
ADDRESS:	Health Communication Network Level 4, 39–41 Chandos Street St Leonards NSW 2065
PHONE:	02 9467 6125
FAX:	02 9906 8910
EMAIL:	dianne.gerlach@hcn.com.au
WEB SITE:	<a href="http://www.hcn.net.au/">http://www.hcn.net.au/</a>
SPONSOR/ PARTNER ORGANISATIONS:	

### Project details

TITLE:	General Practice Clinician Decision Support (Medical Director)	TYPE:	Commercial
SETTING:	Primary Care	STATUS:	Completed
LOCATION:	National	COMMENCED:	1985
USER BASE:	> 100 users	DURATION:	N/A
FREQUENCY OF USE:	15,000 GPs use system daily		
BUDGET:	\$0.00 not disclosed	FUNDING:	Self funded
PRINCIPAL FUNDING SOURCE:	Industry/revenue		

### Description

Desktop software enabling decision support embedded into GP's daily workflow. It manages health records, embeds results, provides prescribing alerts, information on evidence based practice, risk calculations etc.



## System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input checked="" type="checkbox"/> Diagnosis <input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	In house prescribing databases, Therapeutic Guidelines, MIMS		
COMMISSIONED:	1985		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Listed on HCN Website		

## System standards

MARKUP:	HTML	SECURITY:	PKI
CODING:	Other	MESSAGING:	HL7
IMAGING:	Other		
HARDWARE:	N/A	SOFTWARE:	

## System evaluation

TEAM:	
METHODOLOGY:	Not done
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Pattern of care: Adverse effects/errors: Efficiency/cost: Adherence to protocol: Quality of care:
IMPACT ON PATIENT OUTCOMES:	Morbidity: Mortality:
BARRIERS TO SUCCESS:	Infrastructure of general practice and limited funding.
ENABLERS TO SUCCESS:	Marketing and training and retaining clinicians involvement into further development.

## Other comments

## 10 MedSeed

CONTACT:	Dr Lior Rauchberger
ADDRESS:	MedSeed Level 2, 448 St Kilda Road Melbourne VIC 3004
PHONE:	03 9862 9000
FAX:	03 9867 7388
EMAIL:	lrauchberger@medseed.com
WEB SITE:	<a href="http://www.medseed.com">http://www.medseed.com</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	ADVISE	TYPE:	Research
SETTING:	Hospital	STATUS:	Pilot study
LOCATION:	VIC	COMMENCED:	Jan 2001
USER BASE:	10–100 users	DURATION:	6–12 months
FREQUENCY OF USE:	Daily		
BUDGET:	\$150,000.00	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Public and private funding – Department of Human Services		

### Description

Hospital based antibiotic decision support system. The system is based on patient specific microbiological growth and allergies. It makes recommendations as to the most appropriate antibiotic to prescribe. It can handle complex patients with multiple infectious diseases such as intensive care patients.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:	Royal Melbourne Hospital data		
COMMISSIONED:	102		
SYSTEM AVAILABILITY:	Public		
REFERENCES:	N/A as pilot study still underway		

## System standards

MARKUP:	XML	SECURITY:	None
CODING:	None	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:	PC based – Windows	SOFTWARE:	C++

## System evaluation

TEAM:	Internal		
METHODOLOGY:	RCT		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured	
	Pattern of care:	Not measured	
	Adverse effects/errors:	Not measured	
	Efficiency/cost:	Measured	
	Adherence to protocol:	Measured	
	Quality of care:	Measured	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured	
	Mortality:	Not measured	
BARRIERS TO SUCCESS: Clinician uptake of system			
ENABLERS TO SUCCESS: Ability to integrate the system with existing hospital systems			

## Other comments

USER BASE:	Used throughout the Royal Melbourne Hospital
PROCESS MEASURES:	Evaluation currently underway so impact cannot be assessed at this point

## 11 Health Insurance Commission

CONTACT:	Anthony Honeyman
ADDRESS:	PO Box 1001 Tuggeranong DC ACT 2901 Australia
PHONE:	02 6124 6333
FAX:	02 6282 5025
EMAIL:	anthony.honeyman@hic.gov.au
WEB SITE:	<a href="http://www.hic.gov.au/">http://www.hic.gov.au/</a>
SPONSOR/PARTNER ORGANISATIONS:	Health Insurance Commission (HIC) and NSW Health Department

### Project details

TITLE:	NSW EHR*Net	TYPE:	Research
SETTING:	All	STATUS:	In progress
LOCATION:	National	COMMENCED:	
USER BASE:	10–100 users	DURATION:	
FREQUENCY OF USE:			
BUDGET:	\$0.00 not disclosed	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:			

### Description

This project will use health information to assist clinicians to improve the management of people with chronic disease and children in two discrete areas of NSW.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	HIC and NSW Health		
COMMISSIONED:	0		
SYSTEM AVAILABILITY:	Public		
REFERENCES:	N/A as pilot study still underway		

## System standards

MARKUP:	HTML	SECURITY:	PKI
CODING:	ICD	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	

## System evaluation

TEAM:	External		
METHODOLOGY:	Qualitative		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Yes	
	Pattern of care:	Yes	
	Adverse effects/errors:	Yes	
	Efficiency/cost:	Not measured	
	Adherence to protocol:	Yes	
	Quality of care:	Not	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Yes	
	Mortality:	Yes	
BARRIERS TO SUCCESS:			
ENABLERS TO SUCCESS:			

## Other comments

MARKUP:	HTML and XML
CODING:	ICD and SNOMED

## 12 HealthSolve Pty Ltd

CONTACT:	Andrew Wiley
ADDRESS:	HealthSolve Level 3, 81 Flinders Street Adelaide South Australia 5000 PO Box 3238 Rundle Mall Adelaide South Australia 5000
PHONE:	08 8236 0400
FAX:	08 8236 0411
EMAIL:	wiley.andrew@healthsolve.com.au
WEB SITE:	<a href="http://www.healthsolve.com.au">http://www.healthsolve.com.au</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	e-Care	TYPE:	Commercial
SETTING:	Hospital	STATUS:	Completed
LOCATION:	International	COMMENCED:	1997
USER BASE:		DURATION:	> 5 years
FREQUENCY OF USE:			
BUDGET:	\$2,400,000.00	FUNDING:	Mixture
PRINCIPAL FUNDING SOURCE:	R&D Grant		

### Description

Clinical decision support system primarily designed for nurses, however is also used by allied health professionals and medical staff. Based on standards of care linking assessments to interventions including treatment plans and pathways with sites building in specific decision support based on their practice.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input checked="" type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:			
COMMISSIONED:	2001		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Conference proceedings – Health Informatics Conference 2001/2002		

## System standards

MARKUP:	None	SECURITY:	Other
CODING:	ICD	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:	In-house	SOFTWARE:	In-house

## System evaluation

TEAM:	Combination	
METHODOLOGY:	Other	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Yes
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Yes
	Adherence to protocol:	Yes
	Quality of care:	Yes
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS:	Site identifying appropriate practice and evidence for the clinician	
ENABLERS TO SUCCESS:	Way the data is used by the clinician and management and effect on practice.	

## Other comments

TYPE:	research component
USER BASE:	Unknown until implemented
FUNDING:	Private, Federal R&D Grant

## 13 Mayne IT

CONTACT:	Kevin Scott
ADDRESS:	
PHONE:	02 9333 0222
FAX:	
EMAIL:	kevin.scott@au.faulding.com
WEB SITE:	<a href="http://www.faulding.com.au/">http://www.faulding.com.au/</a>
SPONSOR/PARTNER ORGANISATIONS:	MicroMedex

### Project details

TITLE:	MicroMedex Interactions	TYPE:	Commercial
SETTING:	Community Pharmacy	STATUS:	In progress
LOCATION:	National	COMMENCED:	2001
USER BASE:	> 100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Every prescription issued		
BUDGET:	\$100,000.00	FUNDING:	Self funded
PRINCIPAL FUNDING SOURCE:	Mayne IT		

### Description

System provided MicroMedex data to participating pharmacists to check for drug interactions. Stand alone application with updates via virtual private network or CD. 1,800 pharmacists participated in the trial.



## System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	MicroMedex USA		
COMMISSIONED:	2002		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	N/A		

## System standards

MARKUP:	Other	SECURITY:	None
CODING:	Other	MESSAGING:	None
IMAGING:	None		
HARDWARE:			
SOFTWARE:	Microsoft Standard		

## System evaluation

TEAM:	Internal	
METHODOLOGY:	Qualitative	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Not measured
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Not measured
	Adherence to protocol:	Not measured
	Quality of care:	Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS:	Absence of accurate customer identification and the lack of information about interaction with natural medicines	
ENABLERS TO SUCCESS:		

## Other comments

SETTING:	Hospital and community pharmacy
Evaluation of system is still in progress	

## 14 MedSeed

CONTACT:	Dr Lior Rauchberger
ADDRESS:	MedSeed Level 2, 448 St Kilda Road Melbourne VIC 3004
PHONE:	03 9862 9000
FAX:	03 9867 7388
EMAIL:	lrauchberger@medseed.com
WEB SITE:	http://www.medseed.com
SPONSOR/ PARTNER ORGANISATIONS:	

### Project details

TITLE:	Compass	TYPE:	Combination
SETTING:	Primary Care	STATUS:	Completed
LOCATION:	National	COMMENCED:	Oct 2000
USER BASE:	> 100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Decision making when outside Doctors comfort zone		
BUDGET:	\$300,000.00	FUNDING:	Private
PRINCIPAL FUNDING SOURCE:			

### Description

Open source XML based decision support browser built for use by GP's. It uses an XML knowledge representation model, which allows both structured and unstructured medical content to be dynamically navigated.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	NRHMC, International Diabetes Society, Gastroenterology Society of Australia		
COMMISSIONED:	501		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	N/A		

## System standards

MARKUP:	DSML	SECURITY:	PKI
CODING:	None	MESSAGING:	Other
IMAGING:	None		
HARDWARE:	PC based – Windows	SOFTWARE:	C++

## System evaluation

TEAM:	Combination		
METHODOLOGY:	Case study		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Measured	
	Pattern of care:	Not measured	
	Adverse effects/errors:	Measured	
	Efficiency/cost:	Not measured	
	Adherence to protocol:	Yes	
	Quality of care:	Not measured	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured	
	Mortality:	Not measured	
BARRIERS TO SUCCESS: ■ Lack of standards ■ Poor quality of content ■ Long term funding model			
ENABLERS TO SUCCESS: ■ Government support ■ Change management within the community ■ Consistency of content development			

## Other comments

SETTINGS:	Also for Hospital ER for protocol
LEVEL OF SUPPORT:	Also has level 2
SYSTEM AVAILABILITY:	Content public and the browser is prop

## 15 Monash University – Centre for Medical Informatics

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PHONE:	03 9594 7500
FAX:	03 9594 7554
EMAIL:	
WEB SITE:	<a href="http://www.med.monash.edu.au/infor">http://www.med.monash.edu.au/infor</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	eBOP, Electronic Birthing Outcomes Program	TYPE:	Research
SETTING:	Primary Care	STATUS:	In progress
LOCATION:	VIC	COMMENCED:	1999
USER BASE:	> 100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Through every episode, alerts are generated		
BUDGET:	\$360,000.00	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Maternity Enhancement Fund, DHS Victoria		

### Description

Database for capture and exchange of maternity episode of care.

### System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	

NAMES:
COMMISSIONED: 1999
SYSTEM AVAILABILITY: Public
REFERENCES:

## System standards

MARKUP: XML	SECURITY: Other
CODING: ICD	MESSAGING: Other
IMAGING: None	
HARDWARE:	SOFTWARE:

## System evaluation

TEAM:	Internal	
METHODOLOGY:	Qualitative	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Yes
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Yes
	Adherence to protocol:	Not measured
	Quality of care:	Yes
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Yes
	Mortality:	Yes
BARRIERS TO SUCCESS: ■ Lack of financial support		
■ Lack of maternity data model		
■ Basic training		
ENABLERS TO SUCCESS: ■ Maternity staff wanted – users very supportive		
■ Immediate outputs – incremental over time		
■ Consultative process, strong relationships with users		

## Other comments

SETTING: Primary care/hospital
CODING: ICD/other

## 16 NSW Health

CONTACT:	Michelle Wensley
ADDRESS:	NSW Health 73 Miller Street North Sydney NSW 2060
PHONE:	02 9391 9742
FAX:	
EMAIL:	mwens@doh.health.nsw.gov.au
WEB SITE:	<a href="http://www.ciap.health.nsw.gov.au">http://www.ciap.health.nsw.gov.au</a>
SPONSOR/ PARTNER ORGANISATIONS:	

### Project details

TITLE:	Clinical Information Access Program	TYPE:	Other
SETTING:	Hospital	STATUS:	In progress
LOCATION:	NSW	COMMENCED:	Jul 1997
USER BASE:	> 100 users	DURATION:	> 5 years
FREQUENCY OF USE:	Daily use		
BUDGET:	\$4,500,000.00 (2002)	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	NSW Health Department, Area Health Services		

### Description

A website that provides intranet and Internet access to a range of knowledge resources including databases, journals and textbooks, clinical guidelines, policies and protocols, and a range of health websites.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input checked="" type="checkbox"/> Consumer information	<input checked="" type="checkbox"/> Critiquing
NAMES:	MIMS, Harrisons, MedWeaver, Therapeutic Guidelines		
COMMISSIONED:	797		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	<a href="http://www.ciap.health.nsw.gov.au/conferences/papers.html#CIAPJournal">http://www.ciap.health.nsw.gov.au/conferences/papers.html#CIAPJournal</a> Articles		

## System standards

MARKUP:	HTML	SECURITY:	Password
CODING:	Other	MESSAGING:	None
IMAGING:	Other		
HARDWARE:		SOFTWARE:	Dreamweaver

## System evaluation

TEAM:	Combination
METHODOLOGY:	Qualitative
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Not measured
	Pattern of care: TBC
	Adverse effects/errors: Not measured
	Efficiency/cost: TBC
	Adherence to protocol: Not measured
	Quality of care: TBC
IMPACT ON PATIENT OUTCOMES:	Morbidity: Not measured
	Mortality: Not measured
BARRIERS TO SUCCESS:	Lack of access to hardware by clinicians, cost, attitudes to using CIAP, slow network speeds, lack of IT staff to support CIAP, poor computer skills and lack of awareness, poor organisational support for use
ENABLERS TO SUCCESS:	Adequate access to hardware, fast Internet connection, identification of a champion, education and training, marketing and communication, integration with implementation of other clinical systems.

## Other comments

SETTING:	NSW Public Health System
SYSTEM AVAILABLE:	Public and Licensed
CODING:	HTML

## 17 Pacific Knowledge Systems

CONTACT:	Glenn Edwards
ADDRESS:	Pacific Knowledge Systems Suite 111, Bay 16, Australian Technology Park Eveleigh NSW 1430
PHONE:	02 9209 4850
FAX:	02 9209 4855
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WEB SITE:	www.pks.com.au
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	LabWizard	TYPE:	Commercial
SETTING:	Pathology	STATUS:	Completed
LOCATION:	WA	COMMENCED:	1998
USER BASE:	10–100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Everytime pathologist reviews laboratory in biochemistry and serology		
BUDGET:	\$0.00 not disclosed	FUNDING:	Mixture
PRINCIPAL FUNDING SOURCE:	Private and public		

### Description

LabWizard™ helps pathologists to add intelligent patient specific comments to their clinical reports automatically.

The system provides tailored patient-specific reporting without interfering with the lab workflow and is based on patented RippleDown technology.

The system is installed on a standard lab PC and allows pathologist to see LabWizard enhanced comments on his/her existing Validator or our graphical Validator, during the patient test review process.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
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FUNCTION:	<input type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input checked="" type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:	Content is installed by client using Ripple Down		
COMMISSIONED:	2000		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Available from website <a href="http://www.pks.com.au">www.pks.com.au</a>		

## System standards

MARKUP:	None	SECURITY:	None
CODING:	None	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:	Microsoft Standards	SOFTWARE:	Microsoft Standards, JAVA Based

## System evaluation

TEAM:	External		
METHODOLOGY:	Qualitative		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Yes	
	Pattern of care:	Yes	
	Adverse effects/errors:	Yes	
	Efficiency/cost:	Yes	
	Adherence to protocol:	Yes	
	Quality of care:	Yes	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured	
	Mortality:	Not measured	
BARRIERS TO SUCCESS:	■ Lack of incentive for pathology provides to implement quality improvement activities		
	■ Lack of remuneration of the provision of specialist advice in pathology		
ENABLERS TO SUCCESS:	■ Well established IT infrastructure in pathology laboratories		

## Other comments

LOCATION:	WA, VIC, ACT, NSW
	Evaluation was done by independent market research surveying survey of pathology providers. Pathology CEOs and GP's. System allows consumer output.

## 18 Department of Health and Ageing

CONTACT:	Louise Kamp
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PHONE:	02 6289 4219
FAX:	
EMAIL:	Louise.Kamp@health.gov.au
WEB SITE:	
SPONSOR/PARTNER ORGANISATIONS:	GPCG and Monash Uni (undertook project)

### Project details

TITLE:	See comments	TYPE:	Research
SETTING:	Primary Care	STATUS:	Completed
LOCATION:	VIC	COMMENCED:	
USER BASE:	10–100 users	DURATION:	6–12 months
FREQUENCY OF USE:	2–3 times per week		
BUDGET:	\$137,330.00	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Department of Health and Ageing with GPCG		

### Description

Dept and GPCG to test whether decision support leads to improved patient outcomes. Trial of a software program (deliver treatment guidelines for diabetes prevention tested for patient outcomes (BP control) against control GPs (7 in each arm) i.e. 7 GP (58 patients) against a 'control' of 53 patients. Outcome: BP control not significantly improved by use of DS system. Commenced Dec 2000 completed Dec 2001.

5-10 patients enrolled for each GP (x 7) seen over 7-8 weeks with 2 minimum visits (entry and exit) plus clinical visits as needed.

### System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	NHMRC Guidelines		
COMMISSIONED:	2000		

SYSTEM AVAILABILITY: Unknown	
REFERENCES:	<p>Patient consent form used including patient feedback on use of the system.</p> <p>GPCG internal evaluation only preparatory to Phase 2 of the IM/IT program in terms of lessons learned, qualitative information (observations etc).</p>

## System standards

MARKUP:	XML	SECURITY:	
CODING:		MESSAGING:	
IMAGING:			
HARDWARE:	Unknown	SOFTWARE:	Unknown

## System evaluation

TEAM:	Internal		
METHODOLOGY:	Other (see ref above)		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured	
	Pattern of care:	Not measured	
	Adverse effects/errors:	Not measured	
	Efficiency/cost:	Not measured	
	Adherence to protocol:	Not measured	
	Quality of care:	No	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Yes	
	Mortality:	Not measured	
BARRIERS TO SUCCESS: Study too small & too short duration, knowledge of EDSS system, lack of standards, lack of evaluation; amount of data entry, data auto collected, rapidly changing medical knowledge, patient compliance limited.			
ENABLERS TO SUCCESS: Ease of use of software, DSS programs need to both stand-alone & integrate with GP desktop, should have relevance to specific patient, capacity for software to conduct audit of pooled data treatment.			

## Other comments

GP willingness to use system in routine practice

## 19 University of Adelaide – Health Informatics

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WEB SITE:	
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Decision Support for Coronary Care Management	TYPE:	Commercial
SETTING:	Hospital	STATUS:	In progress
LOCATION:	SA	COMMENCED:	April 2002
USER BASE:	10–100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Daily use		
BUDGET:	\$0.00	FUNDING:	Mixture
PRINCIPAL FUNDING SOURCE:	N/A		

### Description

Developing a electronic health record and risk management system for the management of coronary care patients including drug decisions support and the intelligent filtering of lab results.

The system is in hospital ward, monitoring drug prescribing and alerting and providing decision support against evidence based guidelines for patient management.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input checked="" type="checkbox"/> Diagnosis <input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input checked="" type="checkbox"/> Consumer information	<input checked="" type="checkbox"/> Critiquing
NAMES:	MIMS, Evidence based guidelines for AMI and unstable angina		
COMMISSIONED:	2001		

SYSTEM AVAILABILITY:	Proprietary
REFERENCES:	N/A

## System standards

MARKUP:	XML	SECURITY:	Other
CODING:	All	MESSAGING:	Other
IMAGING:	None		
HARDWARE:	Internal standards	SOFTWARE:	C++/Visual Basic/ XML/SQL Server/ Win 02

## System evaluation

TEAM:	External
METHODOLOGY:	Before/after sample
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: TBC
	Pattern of care: TBC
	Adverse effects/errors: TBC
	Efficiency/cost: TBC
	Adherence to protocol: TBC
	Quality of care: TBC
IMPACT ON PATIENT OUTCOMES:	Morbidity: TBC
	Mortality: TBC
BARRIERS TO SUCCESS:	Funding – hospital investment in quality improvement Change management within hospitals Lack of standardisation within hospital
ENABLERS TO SUCCESS:	Strong head of unit A co-operative hospital IT unit Key stakeholders to be part of implementation and development stages

## Other comments

LITERATURE:	Internal drug management, warfarin and heparin management and includes inference engines
SECURITY:	Hospital intranet – Coding: ICNI/Snowmed/UMLS/other – Messaging: encryption and XML

## 20 Alliance of NSW Divisions

CONTACT:	Ray Dooley
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PHONE:	02 9239 2900
FAX:	02 9239 2999
EMAIL:	raydooley@answd.com.au
WEB SITE:	<a href="http://www.answd.com.au/">http://www.answd.com.au/</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Enhanced Primary Care Education and Community Linkages	TYPE:	Research
SETTING:	Primary Care	STATUS:	In progress
LOCATION:	NSW	COMMENCED:	1999
USER BASE:	>100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Every patient visit		
BUDGET:	\$20,000.00	FUNDING:	Self funded
PRINCIPAL FUNDING SOURCE:	Alliance		

### Description

About providing education and training to the general practitioners on the use of Medicare item numbers. Software was developed by Division of General Practice to help doctors to identify patients eligible for Medicare rebate.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:			
COMMISSIONED: 1999			
SYSTEM AVAILABILITY: Public			
REFERENCES: Australian Health Care General Practice Guidelines			

## System standards

MARKUP:	None	SECURITY:	None
CODING:	None	MESSAGING:	None
IMAGING:	None		
HARDWARE:	None	SOFTWARE:	None

## System evaluation

TEAM:	None
METHODOLOGY:	Not done
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Not measured
	Pattern of care: Not measured
	Adverse effects/errors: Not measured
	Efficiency/cost: Not measured
	Adherence to protocol: Not measured
	Quality of care: Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity: Not measured
	Mortality: Not measured
BARRIERS TO SUCCESS: Computer literacy and constant changes in Medicare items by HIC	
ENABLERS TO SUCCESS: None	

## Other comments

## 21 Price Waterhouse Coopers

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PHONE:	02 8266 5321
FAX:	
EMAIL:	richard.john.baldwin@ua.pwcglobal.com
WEB SITE:	<a href="http://www.achse.org.au/frameset.htm">http://www.achse.org.au/frameset.htm</a>
SPONSOR/PARTNER ORGANISATIONS:	Northern Sydney Area Health Service – specifically, Hornsby Hospital, Royal North Shore Hospital, Ryde Hospital, Hornsby Ku-ring-gai Division of General Practice, Home Care Services NSW, Sydney Home Nursing Service.

### Project details

TITLE:	Hornsby Ku-ring gai Coordinated Care Trial	TYPE:	Research
SETTING:	Community Care	STATUS:	Completed
LOCATION:	NSW	COMMENCED:	1999
USER BASE:	>100 users	DURATION:	3–5 years
FREQUENCY OF USE:	Used with each enrolled patient		
BUDGET:	\$1,300,000.00	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Northern Sydney Area Health Service		

### Description

Trial to improve outcomes for enrolled cohort of people with chronic and complex conditions using care co-ordination and pooled funding. Eleven hundred patients involved in the trial. Personalised consumer information was provided by a system.



## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	Best Practice Guidelines published by professional bodies		
COMMISSIONED:	1997		
SYSTEM AVAILABILITY:	Public		
REFERENCES:	Technical evaluation of co-ordinated care trial on Commonwealth Department of Health and Ageing website.		

## System standards

MARKUP:	None	SECURITY:	None
CODING:	None	MESSAGING:	None
IMAGING:	None		
HARDWARE:	N/A	SOFTWARE:	N/A

## System evaluation

TEAM:	Internal	
METHODOLOGY:	Other	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Not measured
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Not measured
	Adherence to protocol:	Not measured
	Quality of care:	Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS:	Recognition by practitioner that they need EDSS Enormous resources and energy of implementation team are required	
ENABLERS TO SUCCESS:		

## Other comments

SETTING:	Primary Care and Community Care
LEVEL OF SUPPORT:	1 and 2
EVALUATION METHODOLOGY:	EDS was only one component of the trial of four.

## 22 Merck Sharp and Dohme & Australian Divisions of General Practice

CONTACT:	Helen Leonard & Jill Fogarty
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FAX:	02 6251 3390
EMAIL:	janet_ellershaw@merck.com /
WEB SITE:	http://www.adgp.com.au/
SPONSOR/PARTNER ORGANISATIONS:	The Pharmaceutical Alliance (CSL, Eli Lilly, GlaxoSmithKline, Merck Sharp & Dohme), C/wealth Dept of Health & Ageing, Central Bayside Div of GP, Hornsby Ku-ring-gai Ryde Div of GP, Hunter Urban Div of GP, Health Comm Network, HIC.

### Project details

TITLE:	Integrated Care Program (Phase 1)	TYPE:	Research
SETTING:	Primary Care	STATUS:	Completed
LOCATION:	NSW	COMMENCED:	1998
USER BASE:	>100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Daily every time patient with specified condition is reviewed based on the patient		
BUDGET:	\$2,700,000.00 “with all parties contributing funding”	FUNDING:	Mixture
PRINCIPAL FUNDING SOURCE:	The Pharmaceutical Alliance and the Commonwealth Government		

### Description

A collaborative initiative established to determine the impact of applying evidence-based clinical guidelines in a primary care setting, implemented in a computerised format for use during the doctor-patient consultation.

The aims were to determine whether a clinical decision support system could be developed, find out whether GPs would actually use this, assess what impact the introduction of a CDSS has on aspects of clinical practice (including consultation time, patient satisfaction) and begin to measure the effect of the program on some clinical and patient outcomes.

### System characteristics

KNOWLEDGE SOURCE: ☐ Commercial database ☐ In-house data ☒ Published data

FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input checked="" type="checkbox"/> Critiquing
	<input checked="" type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:	National Asthma Council Guidelines		
COMMISSIONED:	1998		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Integrated Care Program, Phase 1, A Pilot Program – Final Report, Feb 2002 Available on request from Merck, Sharp & Dohme or Commonwealth DoHA		

## System standards

MARKUP:	Other	SECURITY:	None
CODING:	Other	MESSAGING:	None
IMAGING:	None		
HARDWARE:	Medical Director	SOFTWARE:	Medical Director

## System evaluation

TEAM:	External	
METHODOLOGY:	Qualitative	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Yes
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Not measured
	Adherence to protocol:	Yes
	Quality of care:	Yes
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS: Low uptake of and skills in IT (project commenced in 1998), lack of existing evidence based guidelines, lack of IT standards as this then required a very high investment.		
ENABLERS TO SUCCESS: Long term vision of partners, commitment to seeing this through, agreed common aim, plus recognition of individual perspectives, fundamental desire of GPs to deliver high quality care, significant investment.		

## Other comments

LOCATION:	NSW and Victoria
LEVEL OF SUPPORT:	1 and 2 Phase 2 of this project commenced 2000 including more vigorous quality in software development and evaluation.
EVALUATION METHODOLOGY:	quantative, qualitative, process study

## 23 Cardinal Healthcare

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FAX:	02 9901 3115
EMAIL:	dsullivan@jadecare.com
WEB SITE:	<a href="http://www.jadecare.com/">http://www.jadecare.com/</a>
SPONSOR/PARTNER ORGANISATIONS:	Canterbury District Health Board (Christchurch, NZ);

### Project details

TITLE:	JADECare Quality & Complaints Management System	TYPE:	Commercial
SETTING:	Acute care & community	STATUS:	In progress
LOCATION:	Australia, NZ, UK	COMMENCED:	July 2001
USER BASE:	<10 users	DURATION:	>5 years
FREQUENCY OF USE:	Potentially continuous (clinical setting)		
BUDGET:	\$800,000.00 Larger projects \$50K to \$100K per site	FUNDING:	Private
PRINCIPAL FUNDING SOURCE:	Company capital		

### Description

System is a single database for any organisation to define business rules for collecting and monitoring data behind any form to produce a report of trends (correlations etc). Each use (e.g., OH&S, Critical Incidents, Security records,) generates user-defined data and management process for data sets (e.g., clinical unit, geographical unit, professional group).

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input checked="" type="checkbox"/> Critiquing
NAMES:	User-defined content		
COMMISSIONED:	0		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Consumer information templates exist that allow “business rules” to prompt data output		

## System standards

MARKUP:	Other	SECURITY:	Other (password)
CODING:	None	MESSAGING:	None
IMAGING:	Other (object scan)		
HARDWARE:		SOFTWARE:	UML; Rational Rose ISO900 compliance

## System evaluation

TEAM:	Combination		
METHODOLOGY:	N/A		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	No	
	Pattern of care:	No	
	Adverse effects/errors:	No	
	Efficiency/cost:	No	
	Adherence to protocol:	Yes	
	Quality of care:	Yes	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	No	
	Mortality:	No	
BARRIERS TO SUCCESS: Executive sponsorship for implementation; rollout change-management needs from paper-based to electronic ie clinical resistance to appraisal/clinical audit.			
ENABLERS TO SUCCESS: Buy-in by end-users in adopting system; clinical understanding			

## Other comments

Quality of data entry is critical in use; software development is of generic tools for the management system for reporting adherence to a ‘process’ governed by a set of business rules eg for clinical adverse events the values are ‘user-defined’.

## 24 Centre for Health Informatics, UNSW

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FAX:	02 9385 1813
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WEB SITE:	<a href="http://www.chi.unsw.edu.au">http://www.chi.unsw.edu.au</a>
SPONSOR/PARTNER ORGANISATIONS:	Canterbury District Health Board (Christchurch, NZ);

### Project details

TITLE:	Computer alerts system to prevent injury from adverse drug events	TYPE:	Research
SETTING:	Hospital	STATUS:	Completed
LOCATION:	NSW	COMMENCED:	1/7/97
USER BASE:	10–100 users	DURATION:	3–6 months
FREQUENCY OF USE:	3000 admissions generated 1116 alerts		
BUDGET:	\$100,000.00 not disclosed	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	National Institute of Standards and Technology		

### Description

Computer alert system to correct errors that lead to adverse drug events by collecting data from a hospital information system.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:			
COMMISSIONED:	1998		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Publications about the system: Presented at HIC Conference in 2001 (proceedings) UNSW CHI Web site		

## System standards

MARKUP:	None	SECURITY:	Other
CODING:	Other	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	

## System evaluation

TEAM:	Internal	
METHODOLOGY:	Case study	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Not measured
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Not measured
	Adherence to protocol:	Not measured
	Quality of care:	Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS:		
ENABLERS TO SUCCESS: Requirements for success: integrated computerised patient database. Ability to program for new patients.		

## Other comments

SECURITY:	Password protection
CODING:	Editor

## 25 Hatrix Pty Ltd

CONTACT:	John Ainge
ADDRESS:	Hatrix Pty Ltd 45a Colbee Court Phillip ACT 2606
PHONE:	02 6282 8511
FAX:	02 6282 8522
EMAIL:	john.ainge@hatrix.com.
WEB SITE:	http://www.hatrix.com
SPONSOR/PARTNER ORGANISATIONS:	Therapeutic Guidelines

### Project details

TITLE:	Electronic Prescribing Decision Support	TYPE:	Research
SETTING:	Primary Care	STATUS:	Completed
LOCATION:	National	COMMENCED:	1998
USER BASE:	>100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Every time a prescribing decision is made		
BUDGET:	\$50,000.00	FUNDING:	Private
PRINCIPAL FUNDING SOURCE:	MIMS		

### Description

Integration of a document based prescribing guidelines into electronic decision support tools.



## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:	Therapeutic Guidelines		
COMMISSIONED:	1998		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	N/A		

## System standards

MARKUP:	HTML	SECURITY:	Other
CODING:	Other	MESSAGING:	Other
IMAGING:	None		
HARDWARE:		SOFTWARE:	MIMS Script

## System evaluation

TEAM:	Internal	
METHODOLOGY:	Before/after sample	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Not measured
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Not measured
	Adherence to protocol:	Not measured
	Quality of care:	Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured
	Mortality:	Not measured
BARRIERS TO SUCCESS: Failure of GPs to participate in trial		
ENABLERS TO SUCCESS:		

## Other comments

System evaluation was problematic due to limited responses from participants.

## 26 Therapeutic Guidelines

CONTACT:	Jonathan Dartnell
ADDRESS:	Therapeutic Guidelines Limited Level 2, 55 Flemington Road North Melbourne VIC 3051
PHONE:	03 9326 9959
FAX:	03 9326 5632
EMAIL:	jdartnell@tg.com.au
WEB SITE:	http://www.tg.com.au
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Electronic Therapeutic Guidelines: Integration, Collaboration and Standardisation	TYPE:	Research
SETTING:	Other	STATUS:	Completed
LOCATION:	VIC	COMMENCED:	Dec 99
USER BASE:	> 800	DURATION:	1–3 years
FREQUENCY OF USE:	Survey underway to determine frequency of use		
BUDGET:	\$99,364.00	FUNDING:	Self funded
PRINCIPAL FUNDING SOURCE:	50 per cent self funded and 50 per cent grant from the National Prescribing Service		

### Description

Integrate separate guidelines into one product and provide single search across guidelines and prepare for implementation into other systems eg prescribing systems.

### System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	Internal knowledge base		
COMMISSIONED:	700		
SYSTEM AVAILABILITY:	Other		

REFERENCES:	Reviewed by: J. Frazer, <i>Australian Prescriber</i> , Vol 25, Issue 3, 2002, page 53 P.R. Fowler, <i>Journal of Pharmacy Practice and Research</i> , Vol 32, Issue 2 2002, page 159
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## System standards

MARKUP:	HTML	SECURITY:	None
CODING:	None	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	Windows, MAC Linux, Unix

## System evaluation

TEAM:	Internal		
METHODOLOGY:	Qualitative		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured	
	Pattern of care:	Not measured	
	Adverse effects/errors:	Not measured	
	Efficiency/cost:	Not measured	
	Adherence to protocol:	Not measured	
	Quality of care:	Not measured	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured	
	Mortality:	Not measured	
BARRIERS TO SUCCESS: As national based product to obtain functionality on all systems in use ie operating on all browsers and systems. Knowledge base challenges of bringing together knowledge from different systems.			
ENABLERS TO SUCCESS: Ensure co-ordination of systems for future product development			

## Other comments

SETTING:	Primary and tertiary care
CODING:	Separate project
SOFTWARE:	Browser requirements – Java enabled browser ie 4.0 plus

## 27 Hatrix Pty Ltd

CONTACT:	John Ainge
ADDRESS:	Hatrix Pty Ltd 45a Colbee Court Phillip ACT 2606
PHONE:	02 6282 8511
FAX:	02 6282 8522
EMAIL:	john.ainge@hatrix.com.
WEB SITE:	http://www.hatrix.com
SPONSOR/PARTNER ORGANISATIONS:	N/A

### Project details

TITLE:	Electronic Prescribing Systems for Hospitals	TYPE:	Commercial
SETTING:	Hospital	STATUS:	Completed
LOCATION:	NT	COMMENCED:	2001
USER BASE:	10–100 users	DURATION:	6–12 months
FREQUENCY OF USE:	Every prescribing decision in the hospital		
BUDGET:	\$1,000,000.00	FUNDING:	Self funded
PRINCIPAL FUNDING SOURCE:	Internal funding from Hatrix		

### Description

Develop a thin client electronic prescribing decision support for community care & hospital environment. System currently in use in the Northern Territory and starting to roll into New South Wales in July 2002.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:	MIMS, Australian Medicine Handbook		
COMMISSIONED:	2002		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	N/A		

## System standards

MARKUP:	None	SECURITY:	Other
CODING:	ICD	MESSAGING:	HL7
IMAGING:	None		
HARDWARE:		SOFTWARE:	Microsoft Standards

## System evaluation

TEAM:	
METHODOLOGY:	
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision:
	Pattern of care:
	Adverse effects/errors:
	Efficiency/cost:
	Adherence to protocol:
	Quality of care:
IMPACT ON PATIENT OUTCOMES:	Morbidity:
	Mortality:
BARRIERS TO SUCCESS:	
ENABLERS TO SUCCESS: Better databases and knowledge sources	

## Other comments

Evaluation of the system has not been planned.

## 28 Health Insurance Commission

CONTACT:	Michelle McDonald
ADDRESS:	Health Insurance Commission PO Box 1001 Tuggeranong DC ACT 2901
PHONE:	02 6124 6627
FAX:	02 6282 5025
EMAIL:	michelle.mcdonald@hic.gov.au
WEB SITE:	<a href="http://www.hic.gov.au/">http://www.hic.gov.au/</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Provider Feedback Reporting Facility	TYPE:	Research
SETTING:	Primary Care	STATUS:	Ongoing
LOCATION:	National	COMMENCED:	FRF 1999
USER BASE:	>100 users	DURATION:	Ongoing
FREQUENCY OF USE:	Quarterly		
BUDGET:	\$0.00	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Health Insurance Commission		

### Description

HIC supplies General Practitioner (GP's) with comparative statistics which show how a GP's business activities compare with others in similar peer groups. The statistics can be accessed over a secured website and provides access to providers' Medicare Benefits Schedule services, benefits, diagnostic imaging, pathology, patient demographics, Pharmaceutical Benefits Scheme and accreditation statistics.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Consumer information	
NAMES:	Medicare Data		
COMMISSIONED:	o		
SYSTEM AVAILABILITY:	Public		
REFERENCES:			

## System standards

MARKUP:	SECURITY:
CODING:	MESSAGING:
IMAGING:	
HARDWARE:	SOFTWARE:

## System evaluation

TEAM:	Internal
METHODOLOGY:	Qualitative
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision:
	Pattern of care:
	Adverse effects/errors:
	Efficiency/cost:
	Adherence to protocol:
	Quality of care:
IMPACT ON PATIENT OUTCOMES:	Morbidity:
	Mortality:
BARRIERS TO SUCCESS:	
ENABLERS TO SUCCESS:	

## Other comments

SETTING:	Pathology/Radiology/Primary Care
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## 29 University of Tasmania

CONTACT:	Prof Gregory M Peterson
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PHONE:	03-62262197
FAX:	03-62262870
EMAIL:	G.Peterson@utas.edu.au
WEB SITE:	<a href="http://www.qummap.health.gov.au/plis">http://www.qummap.health.gov.au/plis</a>
SPONSOR/PARTNER ORGANISATIONS:	DOCLE for Medical Coding; MIMS (HCN); Phoenix Computer Systems

### Project details

TITLE:	Development and evaluation of a computerised system for the provision and documentation of community pharmacists' cognitive services.		
TYPE:	Research		
SETTING:	Community Pharmacy	STATUS:	In progress
LOCATION:	TAS	COMMENCED:	2002
USER BASE:	10–100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Continuous access, frequency to be evaluated		
BUDGET:	\$95,000.00	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Commonwealth Department of Health via Community		

### Description

The research team is developing and evaluating a convenient mechanism for the recording of community pharmacists' cognitive services. The system will be easy to use and interface with dispensing software.

The team envisages that the system will become an Australia-wide standard. It is initially being developed for incorporation into the Rex system (Phoenix Computer Systems).

A generic approach is being adopted in the design of the system, so that it can be later modified for use by as many dispensing software vendors as possible. The documentation system will be problem-oriented.



## System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input checked="" type="checkbox"/> Diagnosis <input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input checked="" type="checkbox"/> Consumer information	<input checked="" type="checkbox"/> Critiquing
NAMES:			
COMMISSIONED:	2002		
SYSTEM AVAILABILITY:	Public		
REFERENCES:			

## System standards

MARKUP:	Other	SECURITY:	Other
CODING:	Other	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	Phoenix Systems

## System evaluation

TEAM:	Combination		
METHODOLOGY:	Qualitative		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured	
	Pattern of care:	Yes	
	Adverse effects/errors:	Not measured	
	Efficiency/cost:	Yes	
	Adherence to protocol:	Yes	
	Quality of care:	No	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Yes	
	Mortality:	No	
BARRIERS TO SUCCESS: Utilisation by Pharmacists in busy practice work-schedule, management of introduction of new processes into the work-flow.			
ENABLERS TO SUCCESS: First of a kind innovation, collaborators are positive in promotion to external users, good collaboration within the team (Phoenix partnership)			

## Other comments

CHARACTERISTICS:	(ADD Professional Development CPE)
SECURITY:	Password
CODING:	DOCLE

## 30 Victorian Department of Human Services

CONTACT:	Catherine Purdon
ADDRESS:	Victoria Department Human Services Level 9, 589 Collins Street Melbourne VIC 3000
PHONE:	03 9616 2791
FAX:	03 9616 8559
EMAIL:	cathy.purdon@dhs.vic.gov.au
WEB SITE:	
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Clinicians Health Channel	TYPE:	Other
SETTING:	Hospital	STATUS:	In progress
LOCATION:	VIC	COMMENCED:	March 2000
USER BASE:	>100 users	DURATION:	3–5 years
FREQUENCY OF USE:	Daily		
BUDGET:	\$10,000,000.00	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	Commonwealth Funding – National Health and Development Fund		

### Description

Website set up by the Department of Human Services to provide clinicians with online access to a range of health care resources.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	MIMS, Micromedics, Aust Medicine Handbook, Therapeutic Guidelines, Medline, Meditext		
COMMISSIONED:	1999		
SYSTEM AVAILABILITY:	Public		
REFERENCES:	Collaborative Interdisciplinary Approach to the Evaluation of the Clinicians Health Channel		

## System standards

MARKUP:	None	SECURITY:	Other
CODING:	None	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	Government policy Guidelines

## System evaluation

TEAM:	Combination
METHODOLOGY:	Qualitative
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Not measured
	Pattern of care: Not measured
	Adverse effects/errors: Not measured
	Efficiency/cost: Yes
	Adherence to protocol: Not measured
	Quality of care: Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity: Not measured
	Mortality: Not measured
BARRIERS TO SUCCESS:	Lack of management support of the initiative. Lack of PC and workspaces, bandwidth, adequate training. Lack of promotion within hospitals, conflict with other resource providers
ENABLERS TO SUCCESS:	Training of clinicians, promotion of system, support for clinicians, usefulness/application of the system.

## Other comments

SETTING:	Community health settings
FUNCTION:	Indirectly
SOURCE:	Also Cochran
SECURITY:	Restricted access via password
CODING:	Not known
EVALUATION:	Surveys, interviews, focus groups

## 31 Queensland Health

CONTACT:	Lyn Perks
ADDRESS:	Queensland Health GPO Box 48 Brisbane QLD 4001
PHONE:	07 3234 1866
FAX:	
EMAIL:	lyn_perks@health.qld.gov.au
WEB SITE:	
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Clinician Knowledge Network	TYPE:	Other
SETTING:	Hospital	STATUS:	In progress
LOCATION:	QLD	COMMENCED:	Feb 2000
USER BASE:	>100 users	DURATION:	>5 years
FREQUENCY OF USE:	Survey: sporadic use (doctors 87% use nurses 50% use approx)		
BUDGET:	\$0.00 not disclosed	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	1st 2 years National Health Department Funds (clinician decision support)		

### Description

Established March 2001. State wide information system. Operates over QLD health wide network with 20,000 PC attached to network, 8,000 approx clinicians. No password access and links to external providers are through single IP validation.

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input type="checkbox"/> Critiquing
NAMES:	MIMS, Micromedix, OVID, Clinical Evidence, MD Consults, Harrison, Online textbooks		
COMMISSIONED:	March 2001		
SYSTEM AVAILABILITY:	Public		
REFERENCES:	N/A		

## System standards

MARKUP:	HTML	SECURITY:	Intranet
CODING:	None	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	Ice Media developed system

## System evaluation

TEAM:	Internal
METHODOLOGY:	RCT
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Yes
	Pattern of care: Not measured
	Adverse effects/errors: Yes
	Efficiency/cost: Yes
	Adherence to protocol: Not measured
	Quality of care: Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity: Not measured
	Mortality: Not measured
BARRIERS TO SUCCESS:	Access to PC in clinical areas, time constraints, training of clinicians, access speed (in particular remote areas).
ENABLERS TO SUCCESS:	Marketing of system in hospitals and staff training.

## Other comments

TYPE:	Public system – access system from home via validation process
FUNCTION:	Clinician access information to aid diagnosis
STATUS:	Computer system
DURATION:	Ongoing

## 32 Health Insurance Commission

CONTACT:	Michelle McDonald
ADDRESS:	Health Insurance Commission PO Box 1001 Tuggeranong DC ACT 2901
PHONE:	02 6124 6627
FAX:	02 6282 5025
EMAIL:	michelle.mcdonald@hic.gov.au
WEB SITE:	<a href="http://www.hic.gov.au/">http://www.hic.gov.au/</a>
SPONSOR/PARTNER ORGANISATIONS:	Health Insurance Commission (HIC)

### Project details

TITLE:	Diabetes Divisions of General Practice Reports	TYPE:	Research
SETTING:	Primary Care	STATUS:	Ongoing
LOCATION:	National	COMMENCED:	2001
USER BASE:	>100 users	DURATION:	Ongoing
FREQUENCY OF USE:		FUNDING:	Other
BUDGET:	\$0.00		
PRINCIPAL FUNDING SOURCE:	Health Insurance Commission		

### Description

This product identifies patients with diabetes who attend doctors in a Division of General Practice. It then presents and collates information on the extent to which patients' with diabetes use relevant Medicare items compared with best practice guidelines. Future plans to provide this information an individual GP level.

### System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input type="checkbox"/> Critiquing
	<input type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input checked="" type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	

NAMES:
COMMISSIONED: 2001
SYSTEM AVAILABILITY: Public
REFERENCES:

## System standards

MARKUP: HTML	SECURITY:
CODING:	MESSAGING:
IMAGING:	
HARDWARE:	SOFTWARE:

## System evaluation

TEAM:	Internal	
METHODOLOGY:	Qualitative	
CONSUMER INPUT IN DESIGN:		
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Not measured
	Pattern of care:	Yes
	Adverse effects/errors:	Not measured
	Efficiency/cost:	Yes
	Adherence to protocol:	Not measured
	Quality of care:	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Yes
	Mortality:	Yes
BARRIERS TO SUCCESS: Funding		
ENABLERS TO SUCCESS:		

## Other comments

SETTING: Pathology/Radiology/Primary Care
USER BASE: All providers: GPs specialists, optometrists etc. and Divisions of General Practice
ADVERSE EFFECTS/ ERRORS: Plan to complete in the future

## 33 Mayne Health

CONTACT: Allen McNeil - C/-Michael Geran

ADDRESS:

PHONE: 03 9244 0444

FAX:

EMAIL: allan.mcneil@maynegroup.com

WEB SITE:

SPONSOR/PARTNER

ORGANISATIONS:

### Project details

TITLE: Path Smart

SETTING: Pathology

LOCATION: National

USER BASE: <10 users

FREQUENCY OF USE: Continuous use (system maintenance will decrease as time progresses)

BUDGET: \$0.00 not disclosed

PRINCIPAL FUNDING

SOURCE: Mayne Health

TYPE: Commercial

STATUS: Pilot study

COMMENCED: 2001

DURATION: 6–12 months

FUNDING: Self funded

### Description

Artificial intelligence system for adding interpretive information to pathology results. The system uses case-based reasoning. System adds interpretive value to results and forwards to pathologist for sign-off.



## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input type="checkbox"/> Info Retrieval	<input type="checkbox"/> Alerts/Reminders	<input checked="" type="checkbox"/> Critiquing
	<input checked="" type="checkbox"/> Diagnosis	<input type="checkbox"/> Therapy planning and management	
	<input type="checkbox"/> Clinical audit	<input type="checkbox"/> Consumer information	
NAMES:			
COMMISSIONED:	2001		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	N/A		

## System standards

MARKUP:	Visual Basic	SECURITY:	Other
CODING:	Not sure	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	Visual Basic

## System evaluation

TEAM:	Combination		
METHODOLOGY:	Underway		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:		
	Pattern of care:		
	Adverse effects/errors:		
	Efficiency/cost:		
	Adherence to protocol:		
	Quality of care:		
IMPACT ON PATIENT OUTCOMES:	Morbidity:		
	Mortality:		
BARRIERS TO SUCCESS:			
ENABLERS TO SUCCESS:	Support from Pathologists, support from the business.		

## Other comments

USER BASE:	Anticipate around 100 users
CURRENT STATUS:	Roll-out underway in Perth – Level 3 & 4
MARKUP:	Not sure
SECURITY:	Login password
EVALUATION:	Currently in progress

## 34 Health Communications Network

CONTACT:	Dianne Gerlach
ADDRESS:	Health Communication Network Level 4, 39-41 Chandos Street St Leonards NSW 2065
PHONE:	02 9467 6125
FAX:	02 9906 8910
EMAIL:	dianne.gerlach@hcn.com.au
WEB SITE:	<a href="http://www.hcn.net.au/">http://www.hcn.net.au/</a>
SPONSOR/PARTNER ORGANISATIONS:	

### Project details

TITLE:	Hospital Based Decision Support	TYPE:	Commercial
SETTING:	Hospital	STATUS:	Completed
LOCATION:	National	COMMENCED:	1997
USER BASE:	>100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Thousands of accesses per day		
BUDGET:	\$0.00 not disclosed	FUNDING:	Mixture
PRINCIPAL FUNDING SOURCE:	HCN began with public funding and then moved to revenue based funding		

### Description

Provision of decision support software and online reference material from a range of sources including full text journals, textbooks, citation databases, interactive teaching modules.

Software delivers single search across all resources and micro portal access by specialty.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input type="checkbox"/> Published data
FUNCTION:	<input type="checkbox"/> Info Retrieval <input checked="" type="checkbox"/> Diagnosis <input type="checkbox"/> Clinical audit	<input type="checkbox"/> Alerts/Reminders <input type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input checked="" type="checkbox"/> Critiquing
NAMES:	MIMS, Therapeutic Guidelines, Published evidence based guidelines		
COMMISSIONED:	1997		
SYSTEM AVAILABILITY:	Proprietary		
REFERENCES:	Refer to web site <a href="http://www.hcn.net.au">www.hcn.net.au</a>		

## System standards

MARKUP:	HTML	SECURITY:	Other
CODING:	Other	MESSAGING:	None
IMAGING:	None		
HARDWARE:		SOFTWARE:	

## System evaluation

TEAM:	External		
METHODOLOGY:	Qualitative		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Yes	
	Pattern of care:	Yes	
	Adverse effects/errors:	Yes	
	Efficiency/cost:	Yes	
	Adherence to protocol:	Not measured	
	Quality of care:	Yes	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Not measured	
	Mortality:	Not measured	
BARRIERS TO SUCCESS: Infrastructure of hospital environment (fire walls etc.) Limited funding			
ENABLERS TO SUCCESS: Champions, quality marketing and training strategies, and retaining clinicians' involvement into further development.			

## Other comments

## 35 University of Adelaide

CONTACT:	Professor Justin Beilby
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WEB SITE:	<a href="http://www.generalpractice.adelaideun">http://www.generalpractice.adelaideun</a>
SPONSOR/PARTNER ORGANISATIONS:	ADAGE Consortium (University of Adelaide, Department of General Practice, AstraZeneca, Aventis, Bayer and Pfizer).

### Project details

TITLE:	Australian Disease Management Approach to Hypertension in General Practice	TYPE:	Research
SETTING:	Primary Care	STATUS:	Completed
LOCATION:	SA	COMMENCED:	2000
USER BASE:	10–100 users	DURATION:	1–3 years
FREQUENCY OF USE:	Every time a relevant patient is encountered		
BUDGET:	\$0.00 not disclosed	FUNDING:	Private
PRINCIPAL FUNDING SOURCE:	Industry Consortium		

### Description

Clustered, randomised controlled trial to examine a role of decision support in the management of hypertension and cardiovascular risk management among patients in general practice.

System includes CD ROMs with information for doctors and patients, website, risk calculators and interactive model for risk modification.

## System characteristics

KNOWLEDGE SOURCE:	<input type="checkbox"/> Commercial database	<input type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval	<input checked="" type="checkbox"/> Alerts/Reminders	<input checked="" type="checkbox"/> Critiquing
	<input checked="" type="checkbox"/> Diagnosis	<input checked="" type="checkbox"/> Therapy planning and management	
	<input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Consumer information	
NAMES:	WHO Guidelines, Monash University Guidelines and Epidemiological data		
COMMISSIONED:	2000		
SYSTEM AVAILABILITY:	Public		
REFERENCES:			

## System standards

MARKUP:	HTML	SECURITY:	None
CODING:	Other	MESSAGING:	None
IMAGING:	None		
HARDWARE:	Microsoft platform	SOFTWARE:	Microsoft platform

## System evaluation

TEAM:	External		
METHODOLOGY:	RCT		
CONSUMER INPUT IN DESIGN:			
IMPACT ON PROCESS MEASURES:	Confidence in decision:	Yes	
	Pattern of care:	Yes	
	Adverse effects/errors:	Yes	
	Efficiency/cost:	Yes	
	Adherence to protocol:	Yes	
	Quality of care:	Yes	
IMPACT ON PATIENT OUTCOMES:	Morbidity:	Yes	
	Mortality:	Yes	
BARRIERS TO SUCCESS:	Connectivity and training of clinicians, doctors' time management, incentive for GPs to use decision support system.		
ENABLERS TO SUCCESS:			

## Other comments

LOCATION:	SA/VIC
<p>Clustered RCT by design for evaluation, qualitative data on process measures and surrogate markers of clinical outcomes showed significant improvement in decision making in subset of GP's using the system.</p>	

## 36 Department of Health – NSW

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SPONSOR/PARTNER	

### Project details

TITLE:	Point of Care Clinical System	TYPE:	Commercial
SETTING:	Hospital	STATUS:	In progress
LOCATION:	NSW	COMMENCED:	1997
USER BASE:	>100 users	DURATION:	>5 years
FREQUENCY OF USE:	Daily use – Multiple times		
BUDGET:	\$0.00 not disclosed (new module \$15,000,000.00 for metro area)	FUNDING:	Public
PRINCIPAL FUNDING SOURCE:	NSW Treasury		

### Description

Enables clinicians to order diagnostic tests and services online. The other module of clinical documentation includes clinical pathways, charting, progress notes. Within each of these modules the DS includes a rules engine, which enables you to build rules relevant to orders. Orders can generate prompt or an alert which provides advice to the user for example, an interaction, an allergy, an adverse drug reaction, or a test that might require a result to be known before a test can be ordered eg Blood test system will prompt to supply time given and dosage. (3 modules, order, results, clinical documentation i.e. pathways, charting etc).

### System characteristics

KNOWLEDGE SOURCE:	<input checked="" type="checkbox"/> Commercial database	<input checked="" type="checkbox"/> In-house data	<input checked="" type="checkbox"/> Published data
FUNCTION:	<input checked="" type="checkbox"/> Info Retrieval <input type="checkbox"/> Diagnosis <input checked="" type="checkbox"/> Clinical audit	<input checked="" type="checkbox"/> Alerts/Reminders <input checked="" type="checkbox"/> Therapy planning and management <input type="checkbox"/> Consumer information	<input checked="" type="checkbox"/> Critiquing

NAMES:	
COMMISSIONED:	1997
SYSTEM AVAILABILITY:	Public
REFERENCES:	Various publications (visit NSW Health web site)

## System standards

MARKUP:	HTML	SECURITY:	Other
CODING:	ICD	MESSAGING:	HL7
IMAGING:			
HARDWARE:		SOFTWARE:	

## System evaluation


TEAM:	Internal
METHODOLOGY:	Before/after sample
CONSUMER INPUT IN DESIGN:	
IMPACT ON PROCESS MEASURES:	Confidence in decision: Not measured
	Pattern of care: Not measured
	Adverse effects/errors: Not measured
	Efficiency/cost: Not measured
	Adherence to protocol: Not measured
	Quality of care: Not measured
IMPACT ON PATIENT OUTCOMES:	Morbidity: Not measured
	Mortality: Not measured
BARRIERS TO SUCCESS:	Inadequate infrastructure eg telecommunications, PCs, lack of clinician education/training, ability of clinicians to adapt/change management within hospitals, funding to pay for system development/implementation.
ENABLERS TO SUCCESS:	Clinical champions, funding, skilled IT resources, commitment from key stakeholders and management, good response time, clinical participation in development of system,

## Other comments

MARKUP:	HTML/XML
SECURITY:	Password
CODING:	Currently ICD, SNOMED to be utilised in the future
EVALUATION:	Currently in progress







# **Appendix B**

## **Literature research and stakeholder consultation on electronic decision support systems**

**Trilogy Information Solutions (International) Pty Ltd**  
**August 2002**



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# EXECUTIVE SUMMARY

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Australia's health information environment is characterised by:

- significant levels of adverse events caused in part by the unavailability of critical information at the point of clinical decision making
- large amounts of evidence and guidelines that could potentially be accessed and considered at the point of clinical decision making
- a rapidly changing base of clinical evidence
- a need for new processes in the evaluation, approval and dissemination of quality clinical guidelines to match the current pace of change in the clinical evidence
- a lack of fundamental standards required for the proper functioning of an electronic knowledge process
- a large number of influential stakeholders
- significant governance and resourcing issues that require a national approach.

Against this background, electronic decision support systems offer the potential to make an important contribution to the quality of healthcare – by providing clinicians with access to relevant, current evidence-based information at the point of care, supporting the process of decision making.

This report commissioned by the National Electronic Decision Support Taskforce presents the findings of a literature search, consultations and forums with clinicians, representative organisations and the health software industry. Our findings are presented under the following headings:

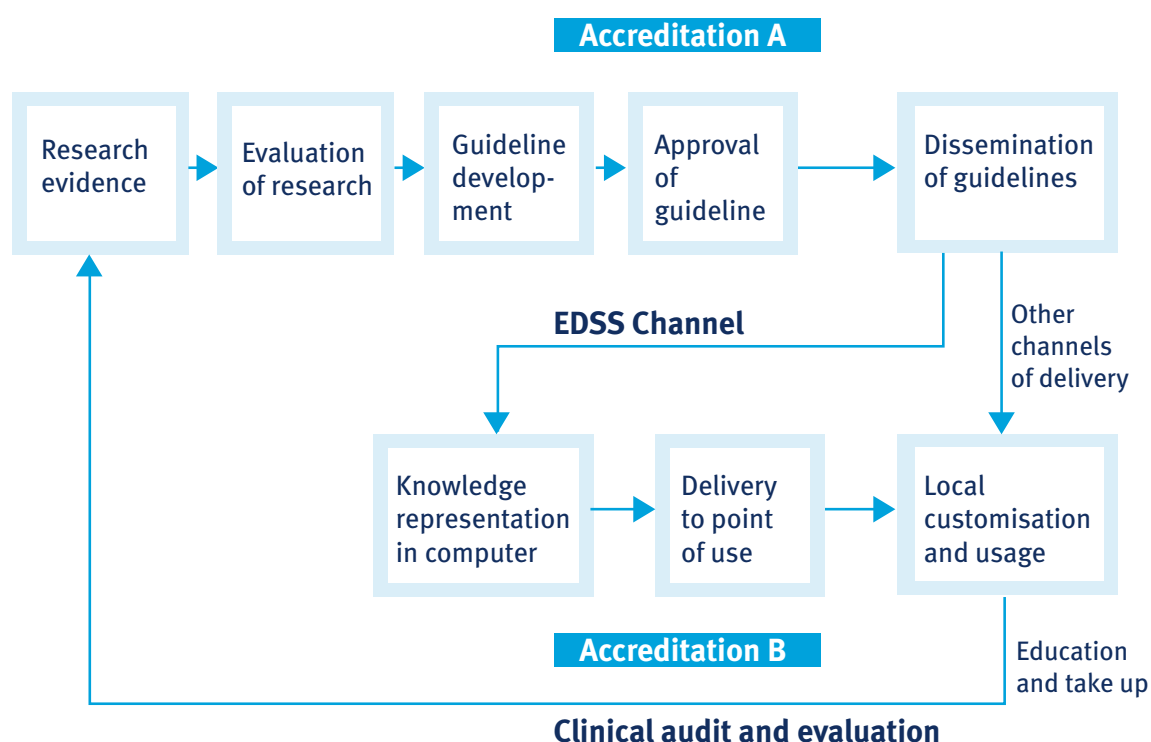
- What are the features of an electronic decision support system that are required by clinicians?
- What will cause clinicians to use them?
- What does the health information industry need to be sustainable in a competitive marketplace?
- What actions are required on a national basis for electronic decision support systems development?

Before presenting the findings, it is useful to understand the current context in which clinical knowledge is obtained, accredited and disseminated.

## 1.1 Clinical knowledge process

The following diagram depicts the clinical knowledge process commencing with the initial research findings, and ending with its delivery to clinicians at the point of care. The diagram shows both the existing process (Accreditation route A) and the additional stages of the process required for the delivery of the clinical guidelines and evidence using an electronic decision support system (Accreditation route B).

FIGURE 1 Clinical knowledge process



### 1.1.1 Components of an electronic decision support system

From our consultations we identified four components that are required in order to implement electronic decision support systems:

- A knowledge component – evaluation and production of clinical guidelines and product information in a variety of media such as paper, CDROM and web based formats and also leading to an electronic decision support system.
- A rules component – translation of knowledge into active electronically based rules that are used within the electronic decision support system.

- A software component – this component applies the knowledge, rules with local adaptation, if applicable, and the local data concerning the clinical encounter and presents the electronic decision support system functionality on the clinician desktop.
- An education and training component – this component covers educational activity concerning knowledge and its use at the under-graduate level, post-graduate level, continuing education, out-reach and consumer education.

The effective deployment of electronic decision support systems also requires:

- A building blocks component covering the standards including data definitions, identifiers, terminology, messaging, format, directories, classifications and code sets as well as security, privacy and capacity building.
- A quality and safety component covering the policy framework for quality and safety, the processes of testing, monitoring and accreditation.

### 1.1.2 Stakeholder groups

The range of stakeholders with a vested interest in the success of Australia's health information industry, including the development and deployment of an electronic decision support system include:

- practising clinicians across a range of professions
- colleges, guilds and representative organisations across the health industry
- universities and other educational organisations
- professional unions
- approving organisations, such as the National Health and Medical Research Council
- government departments, agencies and statutory authorities
- private sector organisations such as hospitals and nursing homes
- the health software industry.

The consultation process included many of these stakeholder groups, although the direction of the consultation was determined by the Taskforce.

## 1.2 Our findings

This section summarises our findings.

### 1.2.1 What are the features of an electronic decision support system that are required by clinicians?

The consultation process identified a range of electronic decision support requirements, although it should be noted that some of the requirements represent components of the clinical information system of which electronic decision support forms part, rather than functions of electronic decision support systems per-se.

The most important features of an electronic decision support system are:

- Prescribing and the processing of orders using rules based on the guidelines produced by the learned bodies. The status of that knowledge and its date of issue are required at the point of prescribing and ordering as well as its reconstruction when a decision is reviewed retrospectively.
- Access to and use of relevant clinical information on the patient derived from other systems as well as information directly entered as part of the electronic decision support process.
- The production of alerts based on a range of factors including known allergies and consumer specific information and the knowledge rules associated with the conditions and proposed interventions, investigations and medications.
- The availability of the evidence behind the decision support rules.
- Prompts and reminders to enhance prevention, recall and reminder processes.
- Information searching of Cochrane and other references that may not be contained within the knowledge base of the electronic decision support system.
- Diagnosis support at the relevant stage of the consultation.
- Access to clinical pathways associated with the presenting problem and diagnosis.
- The ability to measure actual practice against peer norms through indicators at a range of levels, eg for an individual clinician, for clinicians across a practice or clinicians across a division or specialty.
- The ability to conduct concurrent as well as retrospective clinical audits.

The Taskforce should consider these aspects of functionality, and if agreed, communicate them to the health information industry as the priority areas for electronic decision support and clinical information system product development.



### 1.2.2 What will cause clinicians to use them?

The reasons for clinicians to use an electronic decision support system can be expressed in two ways – either as opportunities, or barriers that need to be overcome.

On the positive side the issues are:

- opportunity for reduced effort and improved processes and workflow
- ability to deliver a better quality of care, safely
- confidence in the knowledge process and the availability of evidence
- comfort with how the system is used
- availability of the system at the point of use
- incentives of using an electronic decision support systems aligned with encouraging improved health prevention and chronic disease management practices
- an education program supporting the uptake of the technology.

The barriers to be overcome are:

- ease of access to the clinical guidelines and the evidence supporting them
- the large number of guidelines with the potential to overload both the clinician and the consumer
- the time required to continually update and incorporate guidelines into local practice
- inadequate mechanisms to ensure guidelines are regularly updated and represent current best practice
- litigation concerns
- short term additional costs both to the clinician and the consumer in terms of time
- longer term costs in terms of the necessary infrastructure, facilities and knowledge bases
- costs and benefits that may accrue to different parts of the health sector
- uncertainty over the problems that may be associated with the use of an electronic decision support system and as yet undiscovered
- security concerns
- dependence on and reliability of the technology.

### 1.2.3 What does the health information industry need to be sustainable in a competitive marketplace?

The issues relevant to the sustainability of the health information industry in a competitive marketplace can be considered in terms of the four components.

For the knowledge component, the issues include:

- coordinated approach to the provision of clinical content in a meaningful way at the point of use
- improved process for developing, authorising and disseminating clinical content to the clinicians at the point of use
- involvement of practicing clinicians in the process of guideline development and review
- improved structure for funding the knowledge process underpinning the electronic decision support systems, recognising the dependence of many representative organisations on their existing product based revenue sources that provide their independence from Government funding.

For the rules component, the issues include:

- establishment of an organisation to coordinate the efforts of the industry in the research and development of electronic decision support rules technology
- lack of substantial body of clinicians with the experience in this subject and the need to continue to support innovation
- improved structure for funding the research underpinning the rules component of the electronic decision support system.

For the software component, the issues include:

- low levels of investment in health technology that currently make it less attractive against the other sectors of the information economy
- the software industry is not in a position to solely take responsibility for the inclusion of knowledge into the electronic decision support system for the point of delivery
- the need to use overseas products because of the capacity constraints of the Australian marketplace
- a forum for regular and open communication between the software industry and the coordinating organisations and government agencies
- the need for a partnership approach to future development
- assurance that accreditation processes will not be cumbersome and costly

- clear road-map for future development supported by commitment to funding.

For the education component, the issues include:

- the approach to training clinicians in information management practices
- the nature of the continuing education of clinicians so as to increase the use of the guidelines
- education incentives that result in improved clinical practice
- the understanding of the legal issues associated with using electronic decision support systems.

Additional common issues across all four components include:

- the need for overall coordination between the components making up electronic decision support
- the availability of a full range of authoritative standards for an electronic health industry including terminology, data definitions, classifications and code sets, messaging, identifiers and decision architectures.

#### **1.2.4 What actions are required on a national basis for electronic decision support systems development?**

For these electronic decision support arrangements to be effective, it is essential that there is a nationally coordinated approach to development of electronic decision support systems, and that a national governance structure is in place to provide direction and coordination. The consultations identified general support for this concept.

A national peak organisation should have responsibility for the overall co-ordination of the health knowledge process. The organisation should also have the authority to approve the standards that are required for the orderly operation of the process. This power is required to fill the gap that currently exists over the status of standards and the obligation to follow them.

We have not examined whether the existing approval responsibility for clinical guidelines that lies with the National Health and Medical Research Council should change but there is a clear feeling in those consulted that there is a need for an improvement in the timeliness of that process if many of the benefits of available clinical guidelines and the electronic decision support systems are to be realised.

Many groups consulted believe that a national peak organisation should be neutral and independent of Government. As with many of the representative organisations, a separate source of funding independent of Government is required to achieve this objective. A method of funding therefore will be required that in some way links with

the production process associated with an electronic decision support system, though in the first instance, government funding may be required to establish the body and support it through its early years.

There are two options for the stage of the process in which knowledge is represented in the rules of the electronic decision support system. In the first option that we have called the centralist option, a single organisation is authorised to acquire the knowledge and convert it into rules for the electronic decision support system under licence from the knowledge owners. The price of the licences would have to be set by regulation.

In the second option that we have called the marketplace option, the national peak organisation only uses standards to cover the rules development stage which operate in an open marketplace of the knowledge owners.

If the peak organisation does decide to follow the centralist model then what is required is likely to be akin to the model operating in the United Kingdom. This model implies that a further organisation is required to undertake the rules generation role. This organisation should be separate from the peak organisation but should be accountable to it under contract.

In either situation, the peak body should consider the establishment of a process of accreditation of the final electronic decision support system. This accreditation will cover how the rules based knowledge is incorporated into the range of computer systems that form the Australian electronic decision support system marketplace. As accreditation will cause the number of players in the marketplace to shrink and the hospital sector requirements are yet to be fully explored, it may be appropriate in the first instance to only apply accreditation to electronic decision support systems developed for use by general practitioners.

The peak organisation will also need to consider whether a requirement to use an accredited electronic decision support system should be mandated in the general practitioner workplace in the first place, in the interests of quality and safety. This is not the case in the United Kingdom at the time of writing this report.

## 2 BACKGROUND

---

The evidence is that electronic decision support systems can assist clinical decision-making and achieve better safety and quality of care by giving clinicians access to relevant, evidence-based information at the point of care.

For electronic decision support systems to make a difference to the quality of healthcare there is a view that a nationally coordinated approach to the development of electronic decision support systems is necessary and that a national governance structure is required to provide direction and coordination on electronic decision support.

As an initial step toward confirming support for this strategy, the National Health Information Management Advisory Council (NHIMAC) jointly held a workshop with the National Institute of Clinical Studies (NICS) in November 2001 on electronic decision support governance.

The workshop participants reached agreement about the need for a national governance arrangement to ensure the development of sustainable, nationally integrated electronic decision support systems.

The workshop also recommended that a Taskforce be established under the auspice of NHIMAC to report to Health Ministers within a short timeframe to provide advice on electronic decision support future directions, including governance arrangements.

The report from the workshop was considered by NHIMAC at its meeting in January 2002. Based on the recommendations in the report, NHIMAC members unanimously agreed to the establishment of a National Electronic Decision Support Taskforce, under its guidance and direction. In February 2002, the Australian Health Ministers' Advisory Council (AHMAC) endorsed the establishment of the Taskforce under the auspice of NHIMAC.

Support for the establishment of the National Electronic Decision Support Taskforce was also given by other key national bodies, such as the National Institute of Clinical Studies (NICS), the National Health and Medical Research Council (NHMRC) and the Australian Council for Safety and Quality in Healthcare (ACSQH).

### 2.1 Objectives of the Taskforce

The Taskforce was formed in May 2002 and operates under the guidance and direction of NHIMAC. The objectives of the Taskforce are:

- identify, at a national level, the work program and national governance arrangements required to ensure the development of sustainable nationally integrated electronic decision support systems
- gain wide support for a nationally co-ordinated approach to the development of electronic decision support systems from key stakeholders
- recommend the way ahead to Australian Health Ministers in sufficient detail to enable them to make decisions and commit resources.

## 2.2 Deliverables

The key deliverables of the Taskforce are:

- A report that provides an inventory of large-scale electronic decision support activities and expenditure in Australia focusing on information that is relevant to the objectives of the Taskforce.
- A review of the evidence about the effectiveness of electronic decision support systems in improving clinical outcomes, the benefits of a more coordinated approach and the barriers to the successful development of electronic decision support systems.
- A statement about the needs of the health information industry and the needs of clinicians as they relate to electronic decision support systems and the uptake of such systems.
- A description of the additional work program that needs to be undertaken and the governance structure that needs to be put in place to ensure the development of sustainable, nationally integrated electronic decision support systems.
- A report to Australian Health Ministers recommending a way ahead, including governance arrangements, priorities, timetables and costing.

## 2.3 Definitions

The Taskforce has defined electronic decision support as:

“Access to knowledge stored electronically to aid patients, carers, and service providers in making decisions on healthcare”.

The Taskforce has also defined a four-type classification system for electronic decision support as follows:

### Type one

Provides base level categorised information that requires further processing and analysis by users before a decision could be made.

### Type two

Presents the clinician with trends of patients' changing clinical status and alerts clinicians to out of range assessment results and intervention strategies. Clinicians are prompted to review information related to the alerts before arriving at a clinical decision.

### Type three

Uses deductive inference engines to operate on some knowledge base and automatically generates diagnostic or intervention recommendations based on changing patient clinical condition, with the knowledge and inferences engines stored in the knowledge base.

### Type four

Uses more complex knowledge management and inference models such as case management reasoning, neural networks, or statistical discrimination analysis to perform outcome or prognostic predications. Such systems possess self learning capabilities and use fuzzy set formalism and similarity measures or confidence level computation as mechanisms to deal with uncertainty intelligently and accurately.

## 2.4 Terms of reference for this consultancy

The terms of reference for this consultancy are:

To prepare a report on:

- the needs of the health information industry in relation to its sustainability and viability
- the needs of clinicians in relation to electronic decision support information and the take-up of electronic decision support.

In preparing the report, it is expected that:

- the report will provide evidence supporting the expansion of the use of electronic decision support systems, whilst acknowledging the critical factors and barriers to successful implementation

■ the required activities will include:

- a review of existing literature, studies and survey documents to determine the needs of industry and clinicians in relation to electronic decision support information
- individual consultations and focus group meetings with the aim of exploring more in depth issues which are of particular importance to these stakeholder groups
- the analysis and synthesis of the collected information describing the key issues impacting on:
  - industry's ability to develop electronic decision support systems in a competitive marketplace
  - clinicians use and take-up of electronic decision support systems.

The findings of this consultancy and the findings of the related consultancy (see 2.5 below) are being consolidated into a single report of the Taskforce.

## 2.5 Related consultancy

The Taskforce has also let a second concurrent consultancy entitled *Electronic Decision Support Activities in Different Health Care Settings* with the following terms of reference:

- Detail the current status of electronic decision support implementation worldwide.
- Include an inventory of large scale or significant electronic decision support activities in Australia.
- Analyse the identified published and unpublished information to:
  - provide an overview of the evidence of the effectiveness of electronic decision support systems in improving clinical outcomes
  - identify factors that are critical to ensuring successful developments of electronic decision support systems on a national basis
  - identify the barriers to the successful implementation and take-up of electronic decision support systems that need to be addressed in the Australian context
  - describe the likely benefits of a co-ordinated approach to the development of electronic decision support systems for clinicians and other key stakeholders.



## 2.6 Methodology for this consultancy

The terms of reference prescribed that the consultation process should utilise a combination of between forty to sixty face to face and telephone interviews with representatives identified by the Taskforce, coupled with forums in four capital cities – Melbourne, Sydney, Brisbane, and Adelaide, involving approximately twenty additional participants per forum across a wide range of stakeholders.

The interviews were held between the 15th July and the 1st August 2002, comprising about fifty participants.

The forums were held in:

- Sydney on the 31st July 2002
- Melbourne on the 1st August 2002
- Brisbane on the 6th August 2002
- Adelaide on the 7th August 2002.

An additional sixty eight participants attended these forums.

The one-on-one interview questions were based on the findings of the literature search and were structured around three different groups of participants:

- the views of clinicians
- the views of the representative bodies
- the views of industry.

The interview questions were reviewed by sub-groups of the Taskforce and pilot tested in the first week of interviews in Adelaide. As a result of those interviews, the questions were refined and the number of questions was reduced. Further feedback was received from the Taskforce and the final set of questions agreed. The detailed questions are attached as attachments to this report.

## 3 LITERATURE REVIEW AND QUESTIONS

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This section examines the literature relevant to the terms of reference of this consultancy. We begin by examining the various definitions of electronic decision support and then review the literature in Australia, the United Kingdom and the United States of America.

### 3.1 Definitions of electronic decision support

The literature search has identified a number of definitions of electronic decision support including:

- The Health Online Report<sup>1</sup> describes “Electronic Decision Support Systems” as consisting of the following:
  - direct electronic access to individual patient records which allows clinicians to determine allergies, current medications and conditions etc
  - electronic links to medical information, journals and specific “chat groups”
  - electronic access to endorsed clinical guidelines and pathways
  - built-in alerts and prompts to assist in treating and prescribing, and on-going monitoring. For example, a practitioner prescribing a specific intravenous antibiotic that could adversely affect renal function can be prompted to check the patient’s renal function both before and during treatment. Such electronic prompts can also advise of potential interactions between current and new medications etc
  - peer support networks and access to second opinion.
- An electronic decision support system compares patient characteristics with a credible knowledgebase and then guides a clinician by offering patient-specific and situation-specific advice. By incorporating evidence-based guidelines and a summary of the patient’s data, or knowledge base, the clinical decision making process is enhanced, thereby potentially improving the quality of care.<sup>2</sup>

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<sup>1</sup> Health Online: A Health Information Action Plan for Australia; National Health Information Management Advisory Council, November 1999

<sup>2</sup> Strategic Future Directions: General Practice Electronic Decision Support Workshop, GPCG, September 1999.

- Electronic decision support allows caregivers to identify the most appropriate treatment based on outcomes assessment and best practice development. These systems focus on improving clinical care by providing timely access to literature, test interpretations, determination of drug dosages, automated warnings and alerts, practice guidelines, and decision analysis.<sup>3</sup>
- Electronic decision support was defined as any software to directly aid in clinical decision making in which characteristics of individual patients are matched to a computerised knowledge base for the purpose of generating patient-specific assessments or recommendations that are then presented to clinicians for consideration.<sup>4</sup>
- Electronic decision support “expert systems” are computer software systems that are designed to aid clinical decision making. Electronic decision support has been defined as provision of assessments of prompts specific to the patient and selected from a knowledge base on the basis of individual patient data. At its simplest this definition will include programs that suggest alternatives for treatment or diagnosis on the basis of a simple algorithm. More complex systems model the likelihood of future events and the effectiveness of proposed interventions based on individual patient data and “knowledge” of risks and the effectiveness of interventions.<sup>5</sup>

Whatever, the definition used, Delaney<sup>5</sup> suggests that “computerised decision support systems are a rapidly advancing and unregulated field, with potential for harm as well as benefit if systems are poorly designed and inadequately evaluated”.

Associate Professor Branko Cesnik has proposed a classification system for electronic decision support systems<sup>6</sup> that may be useful in assessing the relative positioning of vendor offerings, and provide a pathway for their further development. The system has four types:

- **Type 1** provides base level categorized information that requires further processing and analysis before a decision could be arrived at.
- **Type 2** presents clinicians with trends of patient’s changing clinical status and alerts clinicians to out-of-range assessments results and intervention strategies. Clinicians are prompted to review information related to the alerts before arriving at a clinical decision.

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<sup>3</sup> Remmlinger E: Next Generation Clinical Systems: Is it Time to Jump? HIMSS 2002, Session 49.

<sup>4</sup> Hunt D, Haynes R, Hanna S, Smith K: Effects of Computer-Based Clinical Decision Support Systems on Physician Performance and Patient Outcomes, JAMA: 280:15, October 1998.

<sup>5</sup> Delaney B, Fizmaurice D, Riaz A, Hobbs F: Can computerised decision support systems deliver improved quality in primary care?: BMJ 1999; 319:1281.

<sup>6</sup> Report of the Electronic Decision Support Governance Workshop, NICS & NHIMAC sponsored, January 2002.

- **Tier 3** uses deductive inference engines to operate on some knowledge bases and automatically generates diagnostic or intervention recommendations based on changing patient clinical conditions, with the knowledge and inference engines stored in the knowledge base.
- **Tier 4** uses more complex management and inference models such as case-base reasoning, neural networks, or statistical discrimination analysis to perform outcome or prognostic predictions. Such systems possess self-learning capabilities and use fuzzy set formation and similar measures of confidence level computation as mechanisms to deal with uncertainty intelligently and accurately.

## 3.2 Summary of findings

The material identified during the literature search can be broadly divided into three categories:

- The experiences of general practice, both within Australia and overseas.
- The experiences of the hospital sector based mainly on United States experience.
- Increasing trends towards accreditation, regulation and legislation.

### 3.2.1 General practice

General practice saw the early adoption of Information Management and Technology (IM&T) in both Australia and the United Kingdom. Initially the emphasis in both countries was on the need to manage prescribing costs, although in the United Kingdom, there was an additional need for general practice systems to support the previous United Kingdom Government's health reforms, in particular general practice fund-holding and Working for Patients<sup>7</sup>.

#### The Australian general practice experience

The Australian literature on electronic decision support in primary care is primarily associated with the legal aspects of using electronic decision support tools by general practitioners. The General Practice Computing Group (GPCG)<sup>8</sup> lead in this area, with the provision of an excellent General Practice guide<sup>9</sup>. We have quoted extensively from this guide, not only because of the clarity of the advice provided,

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7 UK Department of Health, Working for Patients, HMSO, 1989

8 [www.GPCG.org.au](http://www.GPCG.org.au)

9 Legal Issues in General Practice Computerisation, prepared for Dept of Health & aged Care and the General Practice Computing Group by Milstsein, B of Corrs Chambers Westgarth and Togno, J of Monash University School of Rural Health

but also because of the potential applicability of the advice to other sectors of the Australian health system considering electronic decision support.

The issues identified by the report include:

- To the extent that IM&T simply provides additional tools for the general practitioner's disposal; no new legal problems will arise.
- Many of the benefits offered by IM&T practices have positive legal ramifications, for example, improved quality and safety, informed consumer participation, focus on wellness rather than illness, use of best practice guidelines, prompt dissemination of clinical information, enhanced privacy, security and confidentiality and improved communication.
- IM&T practices operate in and are subject to the same laws as general practitioner's paper based practices (with some exceptions).
- Fundamentals of good care and medico-legal practice still apply.
- The challenges of IM&T and the evolving and expanding regulatory and legislative requirements will not require the general practitioner to become a legal or computer expert, though a degree of "upskilling" will be required in both areas.
- The law requires the general practitioner to exercise only "reasonable" – not perfect – care.
- The spectrum of IM&T proficiency accepted by the court is likely to shift over time to the detriment of the "IT Luddite".
- General practitioners need to be aware of the impending changes to the legislative and regulatory scene.
- It is likely that over time, failure to adopt IM&T practices – particularly where there is a demonstrable benefit to patient care – will become increasingly difficult to defend from a medico-legal perspective.
- It will be increasingly difficult for general practitioners to avoid the use of IM&T given patient demands and expectations, the practices of competitors and regulatory requirements.
- General practitioners will need to be aware of developments and comply with new laws, regulation and legislation as and when they appear.

The GPCG advice to general practitioners is:

- Become proficient with the technology.
- Ensure use of technology is appropriate for the situation.
- When in doubt as to whether IM&T might deliver an inferior service, go with the conventional option.

- Inform medical defence or insurers of the nature and scope of IM&T practices, particularly where the general practitioner enters the more “entrepreneurial” fields or establish new collaborative relationships.
- Where the quality of the service is dependent upon the performance of other professionals, make sure each party understands their rights, responsibilities and obligations, both at common law, and if appropriate, under contract (for instance telemedicine consultations or second opinions).
- Where contractual obligations are unclear, clarify them, if necessary with expert input.
- Ensure the patient is comfortable with the way in which the IM&T practice affects them and their personal health information.
- Good records are the best defence.
- A common sense approach to data collection, retention and storage should prevail.

The advice specifically relating to electronic decision support tools includes:

- The complexity of legal issues are likely to increase along with the complexity of electronic decision support tools.
- The special characteristics of electronic decision support places them apart from conventional sources of information, as these tools “insinuate” themselves invisibly into the decision making process.
- General practitioners need to satisfy themselves as to the following questions:
  - Who creates the information upon which the general practitioner is relying?
  - How reliable is the information and does it compare favourably with the usual sources of information?
  - Does there exist, and if not, should there exist, some independent means of verifying the quality and reliability of the product?
  - What is the general practitioner’s legal responsibility if the patient is harmed through some “inadequacy” in the product?
  - What is the legal responsibility of the technology-provider?
  - If the technology provides any short-cuts, for example, either by making calculations, suggestions or recommendations, what is the general practitioner’s legal responsibility if the advice is disregarded? What is the general practitioner’s legal responsibility if the general practitioner depends upon the advice without independently seeking to exercise clinical judgement as to the reliability of the calculation, recommendation or suggestion?
- The good news is that the common law only requires “reasonable care” to be exercised. Peak bodies will increasingly adopt strategies to maintain the benefits

of using technology while ensuring appropriate protection of practitioners and consumers. General practitioner's will be obliged to be aware of and keep up to date with these developments.

Apart from the legal barriers to using electronic decision support, other general practitioner barriers identified during a General Practitioner Electronic Decision Support Workshop include:

- Ease of access to guidelines and general practitioner information and guideline overload.
- The time required to undertake the consultation, both in terms of using general practitioner systems as well as the time required to evaluate best practice.
- The nature of the general practitioner interface, and whether the electronic decision support facilities are active (prompt-based) or passive (text based).
- Immaturity of guidelines on prevention.
- Inadequate mechanisms to ensure guidelines are regularly updated.

Possible resolutions identified include:

- The implementation of a guideline validation process.
- A coordinated effort around the production, update and dissemination of authoritative prevention resources. A coordinated body sponsored to undertake this activity could oversee the development and implementation of protocols and guidelines and provide a basis for accreditation of decision support resources.
- Common standards for representation and classification by software vendors.
- Greater collaboration between general practitioner representatives and software vendors.
- The provision of education and remuneration incentives for general practitioners to use electronic decision support in some areas, for example, health prevention.
- The need to progress electronic decision support in a strategic manner.

The workshop identified the following strategic issues in progressing electronic decision support:

- Coordination challenges, so that clinical content is developed in a way which is meaningful at the point-of-care, including improved structures and funding for general practitioner research, underpinning electronic decision support.
- System challenges, including the process for developing, authorising and disseminating clinical content.



- User interface and training, including speed of access and useability and awareness campaigns to improve general practitioner understanding of electronic decision support.
- Technical requirements including interface standards, coding and classification, security and privacy.
- Governance, including the roles of peak professional bodies, academic bodies, NHMRC, Divisions of General Practice and the General Practice Computing Group (GPCG).

### The United Kingdom general practice experience

The United Kingdom experience is somewhat different. As one of the earliest adopters of IM&T and electronic decision support (for prescribing), the United Kingdom probably leads the field in primary care computing. Here the emphasis has been on accreditation, and more recently, the regulation of clinical content.

Accreditation of the proliferation of general practice systems in the early 1990's led to a dramatic reduction in the number of software vendors (itself an important issue in considering accreditation options for Australia). Accreditation was primarily concerned with functionality to support the previous Government's reforms (with the emphasis on supporting general practice fund-holding). All United Kingdom general practice systems were accredited in line with the Requirements for Accreditation and general practitioners were encouraged to purchase only accredited systems.

Requirements for Accreditation is still a requirement for general practice systems and is updated on a regular basis, in line with changing national information requirements. The emphasis of the Requirements for Accreditation is mainly administrative, with one exception – general practice systems must incorporate and use PRODIGY. PRODIGY offers clinical management advice following a diagnosis, including:

- prescribing and non-drug advice
- doctor/patient shared screens
- patient information leaflets
- advice on when to refer and when to investigate
- reference and learning materials available for use outside the consultation.

The management of PRODIGY now rests with the National Institute for Clinical Excellence (NICE). NICE's remit is to provide patients, health professionals and the



public with authoritative, robust and reliable guidance on current “best practice”<sup>10</sup>, although its role is far wider than just the management of PRODIGY.

Clinical content for PRODIGY is provided by the Sowersby Institute of Health Informatics<sup>11</sup> under contract to NICE. Accreditation of clinical content involves extensive clinical evaluation by recognised experts, and clinical content is updated regularly in line with changing best practice. A new Web-enabled consultation and validation process is being developed to speed up the process of validating new clinical material for inclusion within PRODIGY<sup>12</sup>.

The availability of electronic decision support material for general practitioners is therefore regulated on a national basis. Despite this, there are still issues regarding the uptake and use of PRODIGY by general practitioners. The National Dissemination Office is attempting to increase the awareness of PRODIGY amongst general practitioners, through a multi-faceted approach combining journal articles, newsletters, information videos, flyers, promotion at general practitioner conferences and national seminars and training sessions, as well as a web site providing training and on-line discussion facilities.

A recently published survey<sup>13</sup> reported awareness and use of PRODIGY by United Kingdom general practitioners in 2001 as follows:

- Awareness of PRODIGY has increased from 67 per cent in 2000 to 72 per cent in 2001.
- PRODIGY use has increased from 9 per cent in 2000 to 12.6 per cent in 2001.
- Targeted questionnaires (to a sample of computerised practices) showed PRODIGY use to be 28.7 per cent, and out of these 50 per cent found PRODIGY easy to use.
- Sixty percent of surveyed general practitioners who had attended an “Introduction to PRODIGY” seminar, run by the National Dissemination Office, said they were positively inspired to use PRODIGY.

These results were based upon a total of 428 respondents (where 325 respondents reported having a general practice system that could support PRODIGY).

The report identified a number of factors that might affect uptake and use of PRODIGY:

- computer skill level
- levels of computerisation within the practice

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<sup>10</sup> [www.nice.org.uk](http://www.nice.org.uk)

<sup>11</sup> [www.schin.ncl.ac.uk](http://www.schin.ncl.ac.uk)

<sup>12</sup> [www.prodigy.nhs.uk/clinicalguidance/consultationandvalidationprocess.asp](http://www.prodigy.nhs.uk/clinicalguidance/consultationandvalidationprocess.asp)

<sup>13</sup> Sowerby Centre for Health Informatics, Awareness & Use of PRODIGY 2001: July 2002

- PRODIGY skills
- motivational factors (including time to learn and use).

Additional factors might include:

- the general practitioner's comfort with the triadic relationship (between the general practitioner, the patient and the computer)
- the nature of the diagnosis.

### Accreditation

The NHS Information Authority<sup>14</sup> (NHSIA) has responsibility for the general practice system Requirements for Accreditation under the auspices of the National Accreditation and Procurement Service (NAPS). The scope of work for NAPS is currently under discussion, but we are advised it is “likely to be some time in the future before NAPS extends to hospital systems”. This is a cautious approach by NAPS given the relative infancy of hospital-based electronic decision support in the United Kingdom, and a very different vendor product market for the hospital sector. However, the Department of Health has recently issued a consultation paper suggesting a national approach to some services, for example, electronic prescribing, across all health settings<sup>15</sup>.

### 3.2.2 The hospital sector

The majority of published literature is in relation to the use of electronic decision support systems by the United States hospital sector, although many of the issues identified will be applicable in the Australian context. The literature predominantly described the experiences of using electronic patient records which tend to include an element of electronic decision support (as a minimum, in the provision of electronic prescribing). There is much less information available on the uptake and use of electronic decision support systems specifically.

The literature identifies a range of barriers to clinician uptake and use of electronic patient records/electronic decision support systems including:

- limitations of the vendor marketplace and product suitability<sup>3,16</sup>
- the reliability and integrity of systems<sup>17</sup>

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<sup>14</sup> [www.nhsia.nhs.uk](http://www.nhsia.nhs.uk)

<sup>15</sup> NHS Information Authority: Delivering 21st Century IT Support for the NHS: National specifications for Integrated Care Records Service, July 2002.

<sup>16</sup> Medical Records Institute: 3rd Annual Survey of EHR Trends and Usage results, 2001.

<sup>17</sup> Stansberry, B: Telemedicine: barriers and opportunities in the 21st century, *Journal of Medicine* 2000 247:615-628.

- history of poor or limited implementations<sup>18</sup>
- perceived lack of benefits<sup>2</sup>
- technical obsolescence<sup>18</sup>
- comfort with the triadic relationship<sup>18</sup>
- additional time requirements<sup>18</sup>
- resistance to altering workflow<sup>19</sup>
- costs and lack of funding<sup>2,19</sup>
- security concerns<sup>19</sup>
- the need for caution and supervision of their practical use<sup>17</sup>
- over reliance and de-skilling of clinicians<sup>17</sup>
- alternative and unknown uses of the clinical data<sup>19</sup>
- lack of technical standards.<sup>16,20</sup>

A further barrier to uptake and use could be the state of the electronic patient record/electronic decision support systems industry. An analysis of the United States marketplace<sup>3</sup> suggests that the availability and implementation of new offerings is moving slowly, the vendor market is in transition, and many vendors are only just beginning to invest in the research and development required to develop new products.

If this is the case (and we believe it to be the case), timing may be on Australia's side.

Suggested ways of overcoming these obstacles to uptake and use include:

- involving clinicians in all aspects of the procurement, planning and decision making processes<sup>3,19</sup>
- identify a diverse range of clinicians (not just clinician champions)<sup>19</sup>
- extensive public relations and internal communications, led by clinicians<sup>18,19</sup>
- well designed clinical screens and functions, involving clinicians in product tailoring, recognising the need for different views and approaches (as opposed to one size fits all)<sup>18,19,21</sup>

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18 Skarulis P, Brill J, Lehman M: Rush Physician Order Entry: From Physician Resisters to Physician Champions, HIMSS 2002, Session 126.

19 Bria W, Berkowitz L, Gaillour F, Wald, J: Physician Adoption Strategies for CPR Systems, HIMMS 99: Session 97.

20 Editorial BMJ 2001 345:991-993.

21 Nygren E, Wyatt JC, Wright P: Helping Clinicians to Find Data and Avoid Delays, Lancet 1998; 352: 1462–1466.

- delivery of early benefits, for example, facilities supporting the management of “frequent flyers”<sup>19</sup>
- ensure clinician comfort with technology well before implementation<sup>19</sup>
- upfront workflow analysis<sup>19</sup> and integration with clinical workflow<sup>20</sup>
- manage clinician expectations<sup>19</sup>
- training tailored to needs of different clinician types (from resistant users to technophiles)<sup>19</sup>
- recognition that the use of clinical systems are at best time neutral for clinicians<sup>19</sup>
- robust and responsive infrastructure<sup>19</sup>
- use of a balance of technology and functionality<sup>19</sup>
- the importance of standards<sup>16,22</sup>
- accreditation of electronic decision support systems<sup>17</sup>
- to improve regulation and remove disincentives for vendors to provide electronic decision support systems<sup>23</sup>
- the use of guidelines rather than the reduced availability of clinician options<sup>24</sup>.

However, Remmlinger<sup>3</sup> suggests that attitudes are now changing as a new generation of computer-literate clinicians take a leading role in the management of healthcare organisations, citing Gartner Group research that by 2005, 75 per cent of clinicians will interact in some way with a computer system.

A recent survey of United States paediatricians<sup>25</sup> reported 97 per cent of American Academy of Pediatrics members use computers for work, while more than 80 per cent use the Web to access medical information. Furthermore, 85 per cent of paediatricians over the age of 60 use a computer for their work.

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22 McDonald, C: The Barriers to Electronic Medical Record Systems and How to Overcome Them: JAMIA Volume 4, No 3, May 1997.

23 Bates DW, Cohen M, Leappe L, Oevrhage J, Shabot M, Sheridan T: Reducing the Frequency of Errors in Medicine Using Information Technology, *An Med Inform Assoc* 2001 Jul;8(4):299-308.

24 van Wijk M, van Der Lei J, Mosseveld M, Bohnen A, van Bommel J: Assessment of Decision Support for Blood Test Ordering in Primary Care. A Randomized Trial: *Ann Intern med* 2001 134(4):274-281.

25 iHealthBeat, August 15 2002.

### 3.2.3 Accreditation, regulation, governance and legislation

#### In Australia

The main source of Australian support for governance in electronic decision support emanates from a report jointly sponsored by the National Institute of Clinical Studies (NICS) and the National Health Information Management Advisory Council (NHIMAC)<sup>6</sup>, although an earlier General Practice Computing Group (GPCG) report<sup>2</sup> also highlighted the need for a more coordinated approach to the development and implementation of clinical guidelines.

The NICS/NHIMAC report recommended that a single national entity be established to determine national governance arrangements for electronic decision support systems in healthcare settings. This consultancy engagement, focusing on “consultations with stakeholders in relation to their business needs (eg software industry) and their information needs (eg clinicians and other end users)” is a direct consequence of this report.

The NICS/NHIMAC report identifies the following barriers to using electronic decision support:

- difficulties in clinicians absorbing the knowledge required to maintain best practice
- the gap between knowledge repositories created by agencies and the incorporation of such knowledge within computer-based products
- lack of ownership of the process of governance, resourcing, tools and evaluation of electronic decision support
- insufficient financial drivers for software vendors to undertake the development work
- lack of standards in relation to “building blocks”
- lack of an economically sustainable model to allow scalability across the health sector.

We believe the hospital sector has additional barriers to uptake and use of electronic decision support including:

- lack of any substantial body of clinicians with experience of using electronic decision support systems within the hospital sector vis-à-vis primary care. Experience is very limited within Australia, fairly limited in the United Kingdom (although uptake and use is increasing in line with Government electronic patient records targets), with most experience of electronic decision support in the hospital sector emanating from the United States and Canada

- the high costs associated with the implementation of such systems within the hospital sector and a lack of funding to adequately implement and evaluate is a severe obstacle to progress
- a complete lack of evidence of use of electronic decision support systems outside of the hospital setting, for example by community health and mental health services
- different vendor funding models within the hospital sector (in terms of licensing arrangements and the absence of subsidies provided by commercial advertising)
- different vendor profiles, as the established clinical decision support products are mainly from the United States, necessitating possibly different governance and accreditation mechanisms in order to ensure these vendors are encouraged to participate
- the high degree of specialisation within the hospital sector, where much of the specialist best practice advice originates. Specialists are likely to require facilities to maintain decision support rules locally, and these facilities are currently available within leading commercial solutions. In contrast, decision support rules for general practice need to take into account the “frequent flyer” issues regularly confronted by general practice<sup>9</sup> as well as the priority areas of prevention, chronic disease management and prescribing<sup>2</sup>. Delaney<sup>5</sup> suggests that much of the knowledge of the specialists is highly context specific and may not be transferable to the primary care setting.

The NICS/NHIMAC report identifies the following issues which need to be addressed for electronic decision support to be advanced:

- Recognition that knowledge generation does not automatically lead to real world uptake.
- Industry is not in a position to take responsibility for incorporating ever increasing knowledge into its products. Additionally, industry cannot be solely responsible for maintaining the currency of changing knowledge in a world of rapidly increasing evidence generation.
- The absence of an entity to deal with the issue of governance at a national level will continue to lead to fragmented and duplicated efforts by stakeholders.
- Reorganising existing agencies in an effort to facilitate the exchange of experiences and developments is unlikely to prove effective. Most electronic decision support development activities are, quite rightly, situation or knowledge specific. Those developing discrete solutions are not able to take on a mantle of national governance, while the number of stakeholders is too large to allow governance by consensus alone.

The workshop made the following recommendations:

- That a single national entity be established as soon as possible to determine national governance arrangements for electronic decision support.
- That this entity report to Health Ministers.
- That NICS, NHIMAC, ACSQH, NHMRC and AHMAC support the establishment of such an entity.
- That a taskforce, similar to the Electronic Health Record Taskforce be created to report to Health Ministers (through NHIMAC and in consultation with AHMAC) within a short timeframe on the role and responsibilities of this entity, having regard to the following issues:
  - current activity and expenditure in the electronic decision support sector
  - evidence of effectiveness of different electronic decision support systems in improving outcomes
  - consultation with stakeholders in relation to their business needs (eg software industry) and their information needs (clinicians and other end users)
  - the areas of highest priority for national governance in terms of health outcomes, improved delivery of research evidence into practice and improved quality and safety of decision support systems.

## Internationally

The United States is the dominant user and supplier of hospital-based clinical decision support systems, and the majority of the cited published literature is of United States origin.

Traditionally, there has been little in the way of accreditation or regulation in the United States clinical systems market, although things are changing.

The following initiatives will undoubtedly influence the uptake and use of clinical decision support systems within the United States in the short-to-medium term, along with mechanisms to ensure clinical standards are adopted:

- initiatives underway within many United States states (following the publication of “To Err is Human”<sup>26</sup>), requiring patient safety programs in due course, in an effort to reduce medical errors and improve the quality of patient care.

Initiatives include:

- mandatory error reporting

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<sup>26</sup> To Err is Human”, Building a Safer Health System. Washington, DC: National Academy Press, 1999

- mandating Joint Commission on Accreditation of Health Care Organisation (JCAHO)<sup>27</sup> patient safety programs
- state legislation
- the possibility of federal funding of information technology initiatives to improve patient safety
- Leapfrog Group<sup>28</sup> initiatives, which recognise and reward health care providers for improvements in protecting patients from preventable medical errors, for example, through the implementation of clinical decision support systems
- rating mechanisms such as Keystone Library Automation System (KLAS)<sup>29</sup> and Five Rights Consulting<sup>30</sup>
- the requirements of the *Health Insurance Portability and Accountability Act* (HIPAA)<sup>31</sup> including standards, unique identifiers, security and electronic signatures and privacy and confidentiality requirements.

### 3.3 Questions for the interview process

The one-on-one interview questions were based on the findings of the literature search and were structured specifically for the three participant groups:

- clinician consultations
- consultations with representative bodies
- industry consultations.

#### 3.3.1 Clinician consultations

The questions used in the clinician consultations were grouped into the following categories:

- clinician details and their degree of exposure to electronic decision support systems
- the electronic decision support information needs of clinicians

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<sup>27</sup> [www.jcaho.org](http://www.jcaho.org)

<sup>28</sup> [www.leapfroggroup.org](http://www.leapfroggroup.org)

<sup>29</sup> [www.healthcomputing.com/klas](http://www.healthcomputing.com/klas)

<sup>30</sup> [www.5rights.com/index.htm](http://www.5rights.com/index.htm)

<sup>31</sup> [www.hipaadvisory.com/regs/HIPAAprimer1.htm](http://www.hipaadvisory.com/regs/HIPAAprimer1.htm)



- electronic decision support quality and safety issues
- governance of electronic decision support systems
- take up of electronic decision support systems
- resourcing
- general comments.

### 3.3.2 Consultations with representative organisations

The questions used in consultation with the representative organisations were grouped into the following categories:

- organisation details
- the need for electronic decision support systems
- electronic decision support quality and safety issues
- national electronic decision support systems
- governance of electronic decision support systems
- resourcing of electronic decision support
- general comments.

### 3.3.3 Industry consultations

The questions used in the industry consultations were grouped into the following categories:

- organisational details and familiarity with electronic decision support systems
- electronic decision support systems market capacity
- electronic decision support quality and safety issues
- governance of electronic decision support systems
- resourcing of electronic decision support
- priorities in moving forward
- general comments.

## 4 SUMMARY OF CONSULTATIONS

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This section of the report outlines the key themes and issues explored during the consultation process. The findings for each category of participants are reported separately, ie – the findings of clinicians, representative bodies and industry.

The detailed questionnaires that informed the consultation process can be found in the attachments of this report.

### 4.1 Outcome of clinicians interviews

#### 4.1.1 Clinician representation

The types of clinicians participating in this part of the consultation included:

- general practitioners
- specialists
- consultant physicians
- anaesthetists
- pharmacists from both acute and community settings
- nursing professions
- allied health practitioners.

The interview participants were from:

- Royal North Shore Hospital/Australian Council for Safety and Quality in Healthcare
- Australian Nursing Federation
- Royal Perth Hospital
- Royal Prince Alfred
- Epworth Private Hospital
- Nepean Hospital
- The Society of Hospital Pharmacists of Australia (SHPoA)
- Flinders Medical Centre

- Department of Human Services (SA)/Oasis
- Fremantle Hospital.

The Australian Nurses Federation expressed concern that the Nursing Profession was too broad to be represented by so few participants, and there would be benefits gained from further consultations prior to the implementation of any recommendations.

#### **4.1.2 The degree of participant exposure to electronic decision support systems**

The participants felt there was a lack of clarity as to what constituted an electronic decision support system, as such systems typically formed part of a more comprehensive patient management system. In attempting to qualify participant's use of electronic decision support systems, the classification system proposed by the Taskforce was considered. Many participants felt that they were using electronic decision support facilities that did not necessarily align with the Taskforce classification system.

Many of the participants had either used medication prescribing or pharmacy dispensing systems or had seen them demonstrated. Participants were also familiar with reminder facilities within systems. Many interviewees had used online medical guideline resources and used them regularly in their work environment, including:

- pharmaceutical databases such as MIMS, A-Z DEX, PPGuide
- biomedical database such as Ovid and Micromedex
- text Books online such as Cochrane, Harrison's and Martindale's
- decision support databases through Therapeutic Guidelines Ltd.

#### **4.1.3 The information needs of clinicians**

The main electronic decision support needs identified by participants were:

- common terminology
- software functionality
- flexible training
- the process of approving therapeutic guidelines
- standard minimum datasets
- standard messaging
- the role of advertising
- privacy.

## Common terminology

Clinicians expressed their concern at the current situation regarding terminology and the variety of interpretations that exists across the health sector. It was suggested that the consolidation of terminology would be a direct benefit to, and a requirement for, any national approach to electronic decision support. This was seen as one of the high priorities for a national body to consider in the short term and would form the foundation for the establishing of a national approach.

The United Kingdom has identified a similar need and is currently developing the Clinical Products Reference Source (CPRS) project<sup>32</sup> in an attempt to define common terminology for medicines and medical devices.

## Software functionality

Participants regarded the portability and reliability of software as an important part of the functionality of an electronic decision support system and believed that the use of handheld devices should be a key component of any future systems.

The ability to exploit web based technology is also important, particularly in providing facilities to the rural sector.

If electronic decision support systems were not available at the point-of-care, some participants felt there would be little motivation in using these systems within some professions.

General practitioners believed that unless the use of electronic decision support systems saved time and money, the impetus for their use would be difficult to sustain.

## Flexible training

The need for appropriate training in the use of electronic decision support systems is an obvious requirement, although the type of training needs to be flexible in order to cater for the different needs of clinician groups. Time spent away from the consultation process needs to be minimised and innovative ways to training explored. It was suggested that training would be less complicated if it were structured around the work practice and such an approach would encourage increased participation and uptake. A similar approach was adopted by the Australian Divisions of General Practice in the deployment of general practitioner desktops.

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<sup>32</sup> [www.nhs.uk/nhsia/ukcprs](http://www.nhs.uk/nhsia/ukcprs)

## The approval process for medical and therapeutic guidelines

Whilst there is a national approach to the production of guidelines through the National Health and Medical Research Council, the process of approving guidelines was seen to be cumbersome by many of the participants. The currency of published guidelines was a particular problem, resulting in limited usefulness of the published guidelines on occasions. The maintenance of guidelines within electronic decision support systems would require mechanisms for the rapid approval of guidelines, their dissemination and incorporation within electronic decision support systems.

## Standard minimum datasets

Clinicians expressed the need for a common clinical dataset, endorsed nationally and incorporated within all appropriate health application software. The lack of guidance in this area was seen to be frustrating and a waste of resources. Currently within Australia there are a variety of datasets in use throughout the health sector. The consolidation of these datasets into a national dataset would improve reporting at all levels of the health system (national, state/territory and locally).

## Standard messaging

Health Level 7 (HL7) is the Australian standard for health messaging currently. Participants believed that the application of HL7 across the industry would dramatically improve the ability of disparate systems to communicate, and improve the availability of data for electronic decision support systems.

Participants endorsed a consistent and coordinated approach to the use of the HL7 standard.

## Advertising in clinical software

Participants expressed concern over the use of advertising of medication in some prescribing software. This was seen as inappropriate, particularly at the time of prescribing. There was concern over the influence that such advertising could have on the decision making process. The use of standards or regulation in the use of advertising within clinical software requires consideration as part of any electronic decision support system implementation.

## Privacy of sensitive data

Health Online<sup>1</sup> has already identified the need for a national approach to privacy, confidentiality and security and Health Ministers are committed to ensuring that the privacy of personal health information is upheld in the electronic environment.

Where the use of electronic decision support systems is locally provided and client information is retained locally by the clinician involved in the provision of care, no new privacy issues arise (apart from normal security and confidentiality constraints). However, where a national approach to electronic decision support systems is adopted, or where electronic decision support systems make use of information provided by external agencies, additional privacy and confidentiality issues will arise.

Participants believe a national electronic decision support system would need to have facilities that mask certain data relating to sensitive issues, for example, sexual health and termination of pregnancy. It would not be appropriate for unrestricted access to patient's clinical information, unless patient consent was provided.

#### **4.1.4 Quality and safety of electronic decision support systems**

Participants identified two aspects to electronic decision support systems quality and safety:

- The need for a patient-centric approach, ensuring holistic care.
- The technical quality and safety of the electronic decision support systems.

##### **Patient centric approach**

Participants believed that electronic decision support systems should be patient centric, enabling a holistic view of the patient's healthcare. The decision making process would include the review of electronically received discharge summaries and discharge plans and a complete medication history for the patient.

Patient information sheets targeted specifically at the needs of patients would not only inform patients about aspects of their own healthcare, but would also encourage a higher level of informed patient participation. Information leaflets could be for specific aspects of healthcare, for example the management of diabetes or asthma, as well as dealing with medication issues such as adverse drug reactions or warnings on inappropriate combinations of prescribed drugs and natural therapies and over the counter medications.

The PRODIGY electronic decision support system incorporated within general practice systems within the United Kingdom include both patient information leaflets and shared screens for use by both the general practitioner and the patient.

##### **The technical quality and safety of electronic decision support systems**

The reliability and accuracy of electronic decision support systems emerged as common themes, particularly as electronic decision support systems are likely to result in an

increased dependence on technology at the expense of conventional peer group consultation. Whilst this may seem an unrealistic concern as the change in delivery format does not preclude any other form of communication, it does raise the issue of the ability of clinicians to trust a source of information that may be seen as infallible. Such a scenario would further strengthen the case for authentication of clinical guidelines and the need for a rigorous test environment and accreditation system.

#### 4.1.5 Governance of electronic decision support

Governance was discussed from two perspectives:

- the need for governance structures to support electronic decision support systems
- the most appropriate body to provide this role.

Participants believed that existing governance structures are currently operating in isolation from one another, and should be consolidated in a national approach to electronic decision support systems.

Participants were reluctant to see the establishment of yet another organisation to manage electronic decision support systems. However, it was acknowledged that no organisation currently provided all of the aspects of the required role, and a broader remit and a re-negotiation of roles would be required.

Whatever organisation was ultimately given the role to manage the national development of electronic decision support systems, appropriate professional representation would be required. Many of the current organisations lacked the necessary representation.

#### 4.1.6 Take up of electronic decision support systems

Participants identified the following issues as likely to affect the take-up and use of electronic decision support systems:

- the consolidation of clinical guidelines for the priority health issues and the incorporation of this guidance within electronic decision support systems at an early stage
- a reduction in adverse events and incorporation of electronic decision support within electronic clinical order functionality and clinical pathways
- improvements in workflow in order to free-up clinician time for what is seen as a time consuming process at the point-of-care
- the use of standard terminology

- incentive payments to encourage the use of electronic decision support systems, for example in health prevention and chronic disease management
- high levels of system availability and access
- availability of initial and ongoing training.

#### 4.1.7 Resourcing of electronic decision support

##### Infrastructure

Participants were concerned that the need for appropriate levels of technical infrastructure, including high levels of access, system availability and performance, would not be recognised in the implementation of electronic decision support systems. Participants believed the ability of healthcare organisations to implement and sustain electronic decision support systems within current financial constraints would prove difficult.

Appropriate resourcing of infrastructure will therefore be important.

##### Long term investment in technology

Many participants believed that electronic decision support systems have enormous potential. However most of this potential has been only partially realised because of the barriers that need to be overcome to implement the systems successfully.

It was suggested that for successful development and increased uptake of electronic decision support applications in Australia there needs to be coordinated national approach. Participants believed that a strong commitment would be required from both Federal and State Governments in order for electronic decision support systems to be successful.

Participants believed that the current spending on Information Management and Technology (IM&T) was not enough for the development of a robust health IM&T industry within Australia.

#### 4.1.8 General comments

Other comments included:

- the need to benchmarking current clinical practices
- a strong focus on the delivery of early benefits
- the need for a long-term commitment to training



- licensing of knowledge content needs consideration
- rural communities have unique requirements and these need to be addressed
- the need for a national web site providing access to clinical resources, in the same way as New South Wales Health provides the Clinical Information Access Program (CIAP)<sup>33</sup>
- access to poisons information and alternative therapies including over the counter medication interactions.

## 4.2 The outcome of interviews with representative bodies

### 4.2.1 Organisation information

The representative organisations selected by the Taskforce are:

- The Cancer Council of Australia
- The Mental Health Council of Australia
- Diabetes Australia
- The Royal College of Pathologists of Australasia
- The Pharmaceutical Society of Australia
- The Royal College of Nursing
- Australian Divisions of General Practice
- Consumers' Health Forum of Australia
- The Heart Foundation
- Open EHR Foundation / IT14 Rep
- National Institute of Clinical Studies

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<sup>33</sup> [www.ciap.nsw.gov.au](http://www.ciap.nsw.gov.au)

The main roles of these representative organisations are:

- to act as the peak bodies providing leadership and advocacy for their respective constituents
- informing government policy
- engaging with the government agencies and promoting the interests of their constituents.

In many cases these organisations have a strong link with both the consumers and the clinical professions associated with the health conditions they represent.

Some of these organisations are also involved with the production of clinical guidelines. For example, the Australian Cancer Network develops and disseminates the clinical guidelines for a number of cancers, which are then referred to the National Health and Medical Research Council for accreditation. Additional professional sub-groups are sometimes affiliated to these organisations, for example, the Clinical Oncology Society of Australia covers 22 craft groups directly associated with cancer.

Diabetes Australia has a contract with the Government to manage the National Diabetic Services Scheme (NDSS) including the provision of information and education services as part of the scheme. NDSS may consider the development of electronic decision support systems-equivalent functionality for consumers within community pharmacies and NDSS outlets.

#### **4.2.2 The need for electronic decision support systems**

The need for electronic decision support systems is diverse across the representative bodies and seems to depend upon a number of issues including:

- the length of time that the organisation has been involved in researching this issue
- their role with respect to clinical guidelines.

The Consumers' Health Forum and Diabetes Australia have a very strong consumer focus.

The need for electronic decision support amongst this participant group includes:

- the provision of better treatment for the patient
- the quality agenda of General Practice (ie quality practice leading to quality outcomes). Electronic decision support system enhances general practitioner management practices

- the need to improve the management of vast amounts of clinical guidelines that are currently in paper form
- the adoption and use of practical advice from specialist bodies
- the ability for organisations to easily update best practice and make it available at the point-of-care
- the need for a responsive approach to the individual needs of patients in order to encourage patients in the good management of their condition
- the need for Diabetes Australia to provide consumer advice on the interpretation of Internet material in relation to their condition
- the Consumers' Health Forum need to empower the consumer and involve the consumer in decision making process
- the availability of electronic decision support systems as part of bedside monitoring in areas such as Intensive Care.

Overall participants have a positive view of the opportunities that electronic decision support systems would bring.

### 4.2.3 Quality and safety of electronic decision support systems

The quality and safety of electronic decision support systems is an issue concerning all representative bodies. Their concerns are listed under the following headings:

- guidelines
- standards
- software industry
- training
- legal
- other.

#### Guidelines

- lack of assured compliance with the national guidelines
- the accuracy and currency of the knowledge content
- the ability of electronic decision support to manage large numbers of guidelines

- the interpretation of the information presented within electronic decision support systems
- the fact that some clinical guidelines may not be easily converted into electronic format. For example the incorporation of guidelines for the management of depression may simplify the decision making process
- the risk of a superficial analysis
- the transparency of electronic decision support advice and the availability of evidence supporting that advice.

### Standards

- the lack of common data definitions and datasets.

### Software Industry

- inadequate collaboration between software developers and the clinical professions
- commercial exploitation, for example, the inclusion of product advertising at inappropriate times during the consultation and decision making process.

### Training

- the need for adequate training in the use of electronic decision support systems
- concerns regarding employers failing in their obligations, particularly in regard to the training of staff in the use of electronic decision support systems.

### Legal

- the level of risk management required
- the implications for duty of care
- the reliability of the electronic decision support software and how quality is controlled
- the implications where data is incomplete, or where data has been masked for reasons of confidentiality, resulting in appropriate clinical decisions being made.

### Other

- the impact of the computer on the clinician consumer triadic relationship.

## 4.2.4 National electronic decision support systems

There was general support for a national system for electronic decision support.

Positive comments included:

- the benefits of consistent standards and guidelines across the jurisdictions.  
Participants believed that there should not be any differences in outcomes across the States and Territories
- a single authoritative system for advising on medication interactions
- the value of sharing products and services and the cross-fertilisation of ideas
- a national approach facilitates the role of national service providers, for example, private pathology services that span a number of jurisdictions
- the priority areas for national systems are in the provision of accredited clinical content and the information exchange protocols required to inter-operate with other state-based and national systems.

### Concerns

The concerns of participants include:

- the logistics of managing a service across nine jurisdictions
- the time required to obtain consensus and agreement
- the time required by practising clinicians
- the time required to achieve compliance
- the practicalities of supporting localisation of the guidelines
- the need for training and support for clinicians and consumers involved in the accreditation process
- the ability of electronic decision support systems to communicate with the community of disparate systems currently operating at both State and Federal levels.

### Role of the representative bodies

Views on the role of representative bodies in a national electronic decision support system implementation include:

- providing advice on the policy issues surrounding all aspects of the governance and use of electronic decision support systems
- raising the awareness of electronic decision support systems

- in some cases, generating the evidence based guidelines to be used in electronic decision support systems
- disseminating information on electronic decision support systems and the guideline development programs. Some bodies have electronic newsletters that are distributed widely and relatively frequently to their members
- representation on committees involved in the national processes
- conducting consumer consultations in relation to electronic decision support systems
- assisting in the training and support of clinicians and consumers participating in accreditation processes
- the monitoring of the quality and effectiveness of electronic decision support systems related guidelines
- the provision of grants to projects that enhance the electronic decision support knowledge base
- forming a judgement on the benefits to society of electronic decision support versus the costs relative to other health initiatives.

#### 4.2.5 Governance of electronic decision support

##### Role of the government

The representative organisations believe that Government has a number of roles. These roles included:

- A strong need for a national decision making body to consolidate national efforts for the future investment in health information systems, innovation and sustainability.
- Funding responsibilities. Without significant funding, the provision of electronic decision support systems facilities meeting safety and quality criteria will not be feasible. Funding should be based on incentives to encourage the required changes, uptake and use.
- The Federal Government is responsible for the provision of the e-health framework through the Health Online initiatives. This framework should include the standards required for the development of electronic decision support systems.
- The Federal Government should ensure that there are mechanisms to ensure the participation of clinicians and consumers in determining electronic decision support system standards.

- The establishment of accreditation processes and compliance with legislative requirements such as privacy.
- The provision of ongoing mechanisms to ensure quality.
- There is a role for government in enabling the creating of electronic decision support system guidelines associated with clinical therapies (the majority of information is held by commercial organisations).
- Representative bodies believe the government should ensure there is an independent evaluation of electronic decision support system provision.

### Non-Government roles

Non-Government roles include:

- The development and provision of electronic decision support system products.
- An independent complaints mechanism.
- Electronic decision support systems intellectual property. Some representative organisations believe the Government has relinquished its role in intellectual property ownership in respect to electronic decision support systems, with much of the knowledge content required by electronic decision support systems in the control of self funded not for profit organisations.

### Standards, accreditation and credentialing

Mechanisms for defining standards, accreditation and credentialing are required. Lessons could be learned from the pathology industry where there is a 25 year history of successful operation in these areas.

For example, the pathology industry standards, accreditation and credentialing include:

- the College's role in continuing education and qualifications that leads to the credentialing of practitioners
- the role of the National Association of Testing Authorities in accrediting facilities
- the National Pathology Accreditation Advisory Committee, with responsibility for the Quality Assurance Program and the issuing of standards for certain pathology investigations.

Participants suggested that the accreditation of software might be more difficult and complex.

## Legal issues

The potential legal issues associated with electronic decision support systems that were identified by participants include:

- responsibilities where the advice provided by electronic decision support systems is followed and subsequently found to be erroneous
- the importance of clinicians fully documenting where the electronic decision support system's advice was not followed
- concern that the liability legislation might be tightened so that the defence of acting in good faith is no longer recognised
- the need to adopt professional risk management strategies when using electronic decision support systems
- concern that electronic decision support systems will not accommodate the specific needs of individual patients in the same way as the conventional consultation, resulting in the potential for increased patient litigation
- the legal liability of hospital employers to ensure adequate training of employees
- electronic decision support systems could reinforce the clinician/consumer relationship, leading to an informed and shared decision making process. The nature of the triadic relationship is key in the successful implementation of electronic decision support systems.

### 4.2.6 Resourcing of electronic decision support

The following issues were identified in relation to the resource requirements of electronic decision support systems:

- Whilst the government is seen as the source of many of the resources required for electronic decision support systems, a number of participant organisations felt that predicted savings associated with avoidance of adverse events could be re-channelled into financing electronic decision support systems.
- There are general concerns about the role of pharmaceutical companies in funding electronic decision support system initiatives, including in-product advertising.
- Government has already committed funding to *HealthConnect* including progressing many of the building blocks required for electronic decision support systems. These include:
  - standards activities
  - privacy



- security
- national architecture
- identifiers
- provider directories
- vocabularies.

The Australian Health Care Agreements (AHCA) currently being negotiated between the Federal and State Governments is seen to be an important opportunity to ensure electronic decision support systems are a national priority over the next five years.

Most of the representative bodies were not direct recipients of recurrent funding from government, although many did receive funds to undertake specific projects from time to time. Currently, government provides funding to assist in the distribution of guidelines but does not currently fund their generation. Many representative bodies make a significant contribution to the knowledgebase required by electronic decision support systems. These organisations were concerned that government should take care not to fund competitor organisations to produce similar guidelines without due consideration to the financial impact that such competition might have on the funding of these representative bodies.

Some participants expressed a view that government should not subsidise the development of electronic decision support software, while others felt there should be greater partnership with industry, including grant funding where current probity rules inhibit the development of key innovations.

## 4.2.7 General comments

### Training

The training responsibilities are shared across a number of organisations including:

- the Universities for undergraduates
- the Colleges for post-graduate training
- schools of nursing.

Increasingly, efforts are being made to develop informatics curricula within a number of educational facilities. Training is being provided for both trainees and fellows. Training includes Internet searching skills as well as how to judge the quality of Internet materials.

Divisions of General Practice provide assistance to general practitioners including:

- the process of selecting the technology tools

- helping general practitioners to understand what they do not know, for example the legal issues associated with using Information Management and Technology
- by acting as trusted advisers.

General practitioners have proved to be fast learners in the use of computer based technologies. However, experience has shown that a separate environment, away from the workplace, is required.

Consumer groups believe there is a significant role for consumers in decisions concerning the type of training clinicians require, including the importance of privacy and secure IM&T practices.

### Integrated care program

The integrated care program operates under the auspices of the Divisions of General Practice, and has the potential to provide significant input into electronic decision support system developments.

The initial proof of concept covered the three areas of:

- cardiovascular disease
- asthma, and
- mental health.

A full randomised clinical trial is proposed for phase two of the project commencing in January 2003. The project will examine important questions such as:

- How do we roll out developments in clinical guidelines?
- Who should maintain the guidelines?
- How should localisation of the guidelines occur?
- How is national coordination achieved?

## 4.3 Industry interview outcomes

### 4.3.1 Organisational details and familiarity with electronic decision support systems

Industry representation covered a variety of leading health solution providers, ranging from small, local operators to large international corporations.

One area of common interest amongst all participants was the need for a morale booster for the Australian health software industry. The participants believed that government should ensure a nationally coordinated approach to inspire confidence, investment and innovation by the health software industry.

The industry participants were from the following organisations:

- Health Communications Network/Medical Director
- Health Communications Network/Medical Director
- Cerner Corporation
- Health Services Direct
- CEO Isoft
- McKesson Pacific
- E Health Australia
- Global Health
- Working Systems
- University of Adelaide, Health Informatics/Alcidion
- Health Informatics Society of Australia
- Information Industry Association
- Therapeutic Guidelines Ltd
- International Business Machines Corporation Ltd

### 4.3.2 Electronic decision support market capacity

#### Electronic decision support systems

All participants professed to have electronic decision support systems available at a variety of Types, Types 1 to 3 being the most common. Some participants professed to have Type 4 electronic decision support systems available to deploy, but cited the down-turn in spending as the reason for the lack of uptake and use within Australia.

Many vendor products are United States or United Kingdom based products and the industry recognised that this can often be a barrier to uptake of systems within Australia. However, participants cited the relative size of the Australian market in comparison to the United States and the United Kingdom as key reasons why it would always be difficult to sustain a totally Australian version of products built from the ground up.

The Taskforce objectives were encouraging to industry participants, who welcomed an ongoing dialogue and a coordinated approach to system requirement definitions and the adoption of standards. Industry participants were confident that regular, open communication and a commitment to dialogue would produce real gains for the Australian health software industry in the long term, and boost industry confidence in the immediate future. However, participants were unsure of the implications of accreditation.

### **4.3.3 Quality and safety of electronic decision support systems**

#### **Standards**

Participants acknowledged that the use of standards and some accreditation currently exist within the industry and further development would not be discouraged. However, it would be necessary to communicate clearly the requirements of government and establish mechanisms that did not make compliance a cumbersome and costly process.

Industry participants believed that greater progress could be made by the rigorous application of current standards, the use of accredited guidelines and knowledge bases only, and the adherence to standards for messaging, privacy and security.

### **4.3.4 Governance of electronic decision support**

Two approaches to governance were considered:

- the need for governance structures supporting electronic decision support systems
- the most appropriate organisation to facilitate this role.

#### **Governance structure**

Industry participants called for a national decision making body to consolidate national efforts for the future investment in health information systems, innovation and sustainability. Participants believed there is a need for a nationally coordinated approach by state and territory governments for further investments to occur by the industry in this area.

## Appropriate body

Industry participants held no firm views on the most appropriate organisation to facilitate this role, but they were clear that the organisation required a high level of policy making and funding, and as such, would probably sit within the structure of the Federal Government.

Industry believed there was a need for coordination and consolidation of the current initiatives and investment in electronic decision support systems. Small investments were not sustainable in the long term and industry believed it was more advantageous to identify a small number of key areas over the next 2–3 years and focus on making these a success with a small number of industry partners.

## 4.3.5 Resourcing of electronic decision support

### Infrastructure

Industry participants expressed concern on the ability of healthcare organisations to sustain electronic decision support system initiatives within the current levels of investment in Information Management and Technology (IM&T). A significant increase in infrastructure investment would be required to enable the delivery of a quality and timely implementation of electronic decision support systems to clinicians nationally. In many cases, healthcare organisations are operating on outdated and redundant technology. Industry participants believed this often resulted in inappropriate criticism of industry.

### Implementation

Coordinated implementation of electronic decision support systems at a national level would be advantageous to both industry and the Federal Government, in terms of economies of scale. Strong national direction was attractive to industry participants in providing clear directions and encouraging industry to invest in the future direction of electronic decision support systems in Australia.

Whilst industry participants saw the implementation of one national system as unrealistic, it was not seen as an impossibility. The preferred approach would be strong Federal Government direction, accompanied by a state implementation from a panel of industry vendors.

### Partnerships

Industry participants are keen to be involved in the development of electronic decision support systems in partnership with the Federal Government to ensure the long term sustainability of such an endeavour. How this might occur would need to be explored

in more detail, but engaging industry will be key to encouraging innovation and investment in this area. Industry participants welcomed the opportunity to be involved in moving electronic decision support systems forward but were clear that this could not occur in the current structure.

### 4.3.6 Priorities for moving forward

The following priorities were identified in moving electronic decision support systems forward:

- Greater investment in the health information technology sector.
- Automation of the end-to-end processes, as opposed to the separate components making up the process. This approach will provide better quality and greater savings.
- Rationalisation of spending on IM&T in healthcare and the undertaking of cost benefit analysis of some of the existing legacy systems.
- The provision of a clear road-map for electronic decision support system developments involving industry, government, clinicians and academia.
- The establishment of an electronic decision support industry reference group.
- Clear direction on the industry and government stakeholders.
- Early agreement on the required standards.

### 4.3.7 General comments

Industry participants had concerns regarding the long term commitment to the electronic decision support systems process and they considered it was the role of government to coordinate a collaborative approach.

Industry participants were cautious in their expectations for the implementation of seamless business processes, although many participants were clear that this would need to occur in order to realise the full benefit of electronic decision support systems.

## 4.4 Forum outcomes

The four forums followed a set format. Following a brief introduction by the facilitator, a member of the Taskforce provided a brief overview of the background to the formation of the Taskforce, its objectives, the two consultancies and the timeframes for reporting.

At the Sydney forum, participants split into two groups along industry and clinical affiliations. The other three forums considered only the clinical questions and as a single group.

At all but the first forum, the first question was addressed by first considering the elements that comprise an electronic decision support systems. The group was then taken through a process of considering the need to use an electronic decision support system, along with the advantages and disadvantages.

Following a break the second question was considered by the group. At this point in a number of forums, the participants were asked to identify the six most important elements of electronic decision support systems. In addressing the second question participants were asked to identify the issues associated with quality and safety, how they might be addressed and who would be the appropriate organisation to address these issues.

The material that follows is a composite picture of the responses from the four forums.

#### 4.4.1 Clinician forum outcomes

Two questions were posed at the forums for discussion by the attendees.

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##### Question 1:

What would cause you to use an electronic decision support system? What would be the advantages – to you, your patients or to the health system? What might be the disadvantages?

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##### Elements of an electronic decision support system

In defining the requirements of electronic decision support systems it is inevitable that participants will identify components of clinical systems that integrate and inter-operate with electronic decision support systems and provide additional operational value to clinicians.

The following list represents the priorities of clinicians in addressing the needs of electronic decision support systems in the context of the wider needs of Electronic Patient Record (EPR)/Electronic Health Record (EHR) and clinical systems in general. The top features are presented in **bold** and were found to be similar in both general practice and hospital settings.

- Integration with other components that make up operational clinical systems.
- Clear and unambiguous identification of the consumer.

- Demographics of both the patient and the populations served.
- **Access and use of the relevant clinical information concerning the consumer (maybe external to the electronic decision support system).**
- **Support for deriving and maintaining a diagnosis or problem list.**
- Treatment support.
- **Clinical pathways.**
- Variance from Pathways.
- Medications – current and history.
- Results (exception to clinical guidelines highlighted, trending, and multimedia).
- **Orders (Prescribing, investigations) (Rules engine based on guidelines to equal the ‘best expert’). The status of knowledge resources and guidelines to be displayed and dated.**
- Links to complementary medicine.
- **Evidence behind the decision tree to allow an informed decision. Decision tree to be transparent and can be re-started at any point. Scenarios to be presented.**
- Localisation of rules.
- System to be responsive to the experience of the clinician – more important in the teaching hospital context.
- **Alerts – Allergies and linked to process of ordering and interpreting results. Grey scale as well as absolute. Ability to use in context of the information pertaining to the specific consumer.**
- **Prompts/reminders – screening, prevention, recall and follow-up abnormal results.** Linkage of outstanding orders to follow-up process and ‘hide’ results and orders once matched and considered.
- **Information Searching – Cochrane, References.**
- Discharge information and procedures.
- **Comparative indicators.**
- **Clinical Audit (concurrent as well as retrospective) and feedback.**
- Outcome measurement.
- Research (patient centric and practice review).
- Adaptive learning.
- Patient Inputs.



- Decision support and/or information for the consumer.
- Messaging with peers and patients and referrals (automated and encrypted).
- Advanced input – voice in, text out. Ability to parse text into data.

## Reasons to use electronic decision support systems

The clinicians' reasons for using an electronic decision support system include:

### Effort and process

- Net business advantage. Electronic decision support systems and clinical systems needs to save clinicians time, or be at least time neutral.
- Clinicians need to get more out of electronic decision support systems than has been put into electronic decision support systems, with information and guidance provided as a by product of the clinical process. The process should not require entering extraneous data.
- Electronic decision support systems must fit within the clinical workflow processes, must be seamless, transparent and user friendly.
- Electronic decision support systems must make life easier and more rewarding for clinicians.
- Fast and efficient access to patient information and decision results.
- Electronic decision support systems must be faster than accessing a paper based resource.

### Better quality of care and safety

- Positive identification of the presenting patient.
- Improved quality of care, at an affordable cost.
- Evidence of improved outcomes.

### Confidence in the electronic decision support systems knowledgebase

- Trust in the 'experts', namely, those providing the knowledge and clinical guidance. Also expressed as the integrity of the knowledge base in that it does not favour sectional interests.
- The ability to see evidence and how it is applied. Understand the algorithm and enter the decision tree at various levels. See the path taken at a previous attendance or consultation.
- The ability to allow for uncertainty in the diagnosis.

- The identification of the boundaries of applicability and estimates of the closeness of fit.
- The ability to adapt to new evidence.
- The ability to locally configure the rules.
- Advice to be succinct, pertinent and acknowledged as useful. The ability to seek more detailed information. Automated prompts and checks on potentially dangerous events.
- Ability to turn off the rules or request more details. This aspect is also expressed as sensitivity, namely, the ability to reduce the “noise”.
- The legal implications of turning the rules off need to be considered, including audit trails and clinician justification in doing so.

### **Comfort with the systems**

- Clinicians need to feel ownership of the electronic decision support system.
- The ability to tailor the electronic decision support knowledgebase for a range of clinical users – intern, consultant, other practitioners and even the consumer.
- Affability (comfort with the system) and ease of use.

### **Availability**

- Having access to a robust electronic decision support systems infrastructure.
- The use of portable hardware (pocket size for example).
- Software – single logon across a range of applications on the desktop.
- Sophisticated display with same look and feel to contextual systems such as EPR/EHR or other clinical systems.
- Point-of-care access.
- Adequate support and training, including ongoing training.
- Availability 24 hours a day, 7 days a week.

### **Continuing education**

- Better continuing education – incorporating up-to-date changes in clinical practice.

### **Communication**

- Support for communication with clinical colleagues.

## Causes not to use electronic decision support systems

The following aspects were identified as causes not to use an electronic decision support system:

- The system is perceived to be directing the decision making process.
- The advice is seen to be a ‘cook book’ approach to clinical practice, and fails to recognise the complexity of the clinical decision making process.

## Advantages of electronic decision support systems

The advantages of an electronic decision support system are identified under the headings of:

- Better patient care.
- Knowledge.
- Information management.
- Improved processes
  - Clinical audit
  - Incentives
  - Education
  - Consumer.

### Better patient care

- Improving quality of care and clinical outcomes.
- Better patient care, and potentially lower risk of litigation, due to the availability of evidence of the decision making process.
- Increased consistency of high quality care.

### Knowledge

- Access to up-to-date evidence and expert opinion.
- Diagnostic support.

### Information management

- Better documentation and integration across the continuity of care, subject to privacy obligations to the consumer.
- Availability of previously recorded information – overcoming human fallibility, with more complete and legible records.

- Patient summary that can be made available to others such as carers.
- Improved communication, for example, discharge summaries submitted electronically to general practitioners.
- Improved data quality through mandatory fields that require entry of data.
- Legible patient records.

### **Improved processes**

- Improved workflow – yet to be demonstrated, but should automate the business process.
- Easier repeat prescribing.
- Potential cost reductions associated with avoidance of duplicate medications and tests.

### **Clinical audit**

- Ability to examine trends, undertake audit and research and provide information for quality management.
- Clinical review processes are enhanced.
- Public health and other epidemiology and health planning opportunities.

### **Incentives**

- Improved practice earnings, where additional health interventions are encouraged and rewarded.

### **Education**

- Improved learning process for clinicians (continuous education).

### **Consumer**

- Empowering consumers to participate in the decision making process.
- Improved information for consumers, for example, patient information sheets.

## **Disadvantages**

The disadvantages of an electronic decision support system are identified under the headings of:

- Cost.
- Information.

- Quality and safety.
- Future concerns.
- Technical.
- Constraints.

### **Cost**

- Short term additional costs both to the clinician and the consumer in term of time.
- Some of the motivation for electronic decision support systems are wrong, for example, cost-savings.
- Costs and benefits may accrue to different parts of the health sector.
- Significant investment is required in order to provide the necessary infrastructure and facilities, as well as the processes of governance.
- Cost of continually updating the knowledgebase and best practice guidelines.
- The knowledge is not ‘free’ but has to be paid for.

### **Information**

- A potential loss of the intellectual property of the specialists.
- Clinicians are required to consider more information – with the potential to overload both the clinician and the consumer.
- Certain complex situations have not been resolved even with paper based guidelines.

### **Quality and safety**

- Potential for inappropriate use by those not qualified to interpret the guidelines.

### **Future concerns**

- Electronic decision support systems comes with its own set of problems that will need to be evaluated.
- Security concerns.
- Increasing dependence on technology.
- Litigation concerns – the system is a two edged sword.
- Clinician could appear to be less skilled in the eyes of the patient, and the potential for de-skilling the clinician.

## Technical

- Reliability of technology.
- Electronic decision support systems requires support.
- Initial training and ongoing training is required.
- Once switched on, the electronic decision support system can not be switched off easily.

## Constraints

- Potential for stifling clinician creativity and innovation.
- Potential for too high a degree of homogeneity.

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## Question 2

What are the quality and safety issues that you believe will impact on an electronic decision support system and how might they be addressed?

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## Issues associated with quality and safety

Whilst participants identified a significant number of issues, there was a positive attitude to the implementation of electronic decision support systems amongst participants. The quality and safety issues identified are now listed under the following five sub-headings:

- The nature of the task.
- Jurisdictional issues.
- Clinical content.
- System issues.
- Testing.

### The nature of the task

- The scale of the task and the number of groups and individuals affected.
- The overlap between craft groups.
- Extent of the investment required.
- Reduced discussion with peers.
- Training/ Continuing education and training and its associated costs.

- The consumer perception of the encounter.
- The implications of the consumer withholding certain information.
- Who will pay for the quality required.
- The legal issues have not been tested by the courts.

### **Jurisdictional issues**

- Jurisdictional complexities and the relationship of the states and territories to the Federal Government.
- The different stages of consideration of these issue by the jurisdictions.

### **Clinical content**

- Potential for the duplication of data in different applications on the desktop.
- Evidence of the appropriateness of the advice.
- Context in which the advice was given, and the need for certain situations to be recreated in line with evidence provided at time of initial use.
- Ability to have the latest evidence and the frequency of updates.
- The implications of ignoring alerts.
- Unique identification of the patient.
- Consistent terminology and code sets.
- Australian relevance of the guidelines and knowledge rules.
- Relevance to the local population or to the specific patient.

### **System issues**

- All systems have a degree of failure. The most likely areas of failure of electronic decision support systems are not yet well known. Impacts of failure are unknown at this stage, therefore it is difficult to manage the risk.
- A range of electronic decision support systems are likely to exist and the process of national uniformity will need to be established.
- Authenticity of the information provider is key (for example passwords or the use of digital signatures).
- The communication channels between clinicians and the developers of electronic decision support systems.
- A ground-up, locally developed solution versus a pragmatic use of existing systems.

## Testing

- Relevance of guidelines to the practice and the need to localise the rules.
- Methodologies for testing clinical content.
- End to end testing and evaluation are required.

## Addressing the issues

In this section, some of the options for addressing the issues raised by participants are identified. Options include:

- Evaluation of the electronic decision support process, through a formal research and evaluation method.
- Content producers to test that electronic decision support system advice matches the intended guidelines.
- Consensus and independent review as part of the guideline production.
- High quality documented information sources.
- Full analysis of the legal issues.
- Place the issue of electronic decision support systems in the public domain and use focus groups to build the required partnerships.
- Undertake opportunity costing of the known impact of adverse events.
- Undertake consultations with consumers to raise awareness of electronic decision support systems.
- Remuneration.
- Drive electronic decision support system implementation through the Medicare Agreements between the Federal Government and the states and territories.
- Regulation of software vendors.
- Use established processes such as NHMRC and IT/14.
- Accreditation of the knowledgebase.
- Purchase rather than develop code sets and vocabulary.
- Focus on underlying standards.
- Endorse clinical content so vendors know which resources to incorporate.
- Develop secure systems with consistent data definitions and quality validation.
- Close the clinical audit loop – look at what is used in practice versus what is implied by the research.
- Ensure compliance with the *Privacy Act 1988* and Code of Information Practice.



## Who should address the issues?

In this section of the forum, the discussion not only identified the groups who should be involved in the resolution of issues but also made comments on the characteristics of those groups. It became clear that there is a requirement for a new organisation to cover particular requirements in managing the development of electronic decision support systems.

For the issues associated with the development of individual guidelines, peer review and approval and content for knowledgebases, the following existing organisations should be considered:

- National Health and Medical Research Council.
- Colleges eg Royal Australian College of General Practitioners, Royal Australian College of Physicians, Royal College of Pathologists of Australasia, Royal Australian College of Radiologists and Royal College of Nurses.
- Disease groups champions eg professional groups associated with the peak bodies such as the Cancer Council of Australia, Diabetes Association, the Mental Health Council of Australia and the Heart Foundation.
- Pharmaceutical Society of Australia, Therapeutic Guidelines Limited, Australian Medications Handbook and other bodies associated with therapeutic information.

**For issues associated with translating evidence into action by clinicians including identification of those areas with the greatest impact:**

- National Institute of Clinical Studies.

**For issues associated with quality and safety:**

- Australian Council for Safety and Quality in Health Care.

**For issues associated with audit and outreach education in therapeutics:**

- National Prescribing Service.
- Drug and Therapeutic Information Service.

**For localisation of guidelines in New South Wales Health:**

- NSW Area Health Services to manage the local variation of guidelines.

**For issues relating to the use of information technology in the health sector:**

- National Health Information Management Advisory Council (NHIMAC)
- Interim HealthConnect Board

- National Health Information Management Group (NHIMG)
- National Health Information Standards Advisory Committee (NHISAC)
- General Practice Computing Group (GPCG)
- Australian Information Industry Association (AIIA)
- Medical Software Industry of Australia (MSIA)
- Standards Australia IT14 and its many subgroups.

The major gap identified is a single governing organisation to coordinate the separate efforts of the guideline and knowledge producers as well as the efforts relating to continuing education and audit. This organisation has to impact the efforts of the groups identified above as well as the directions taken by the states and territories.

The organisation will require funding, although participants expressed strong opinions that the organisation should be neutral and independent of government.

#### 4.4.2 Industry forum outcomes

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##### Question 1

What can you hope to offer clinicians to ensure take up of an electronic decision support system?

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Industry considered this question in light of what they believed they could currently offer but also considered the steps required in achieving some of the more sophisticated aspects of electronic decision support systems including:

##### **Consolidation of information within one desk top, including:**

- Passive or interactive information in the relation to the patient consultation.
- Patient centric approach.
- Information available at the point-of-care.
- Software that is flexible and adaptive.
- Portability of information.
- Information on interactions with complementary medicines.
- Patient information from independent sources, credible and vetted.
- Standard representation of data.
- Support for different authorised clinical terminology.

- Ease of access.
- Intuitive interfaces.

### **Configurable decision support with varying alert levels and configurable uploads**

- Timely availability of results, including range checking and the filtering of results requiring the attention of the clinician.
- Proactive electronic decision support systems.
- Time savings on ordering repeat drugs and other orders.
- Reduced risks of adverse events.

### **Security and Privacy including**

- Compliance with the *Privacy Act 1988* as it evolves.
- Systems built on validated data.
- Configurable access to data, for example, masking of sensitive data, and the separation of information into differing specialties.
- Feed back analysis.
- Audit trails supporting practice review.
- Full audit trails.
- Connectivity and integration with disparate systems supporting the continuum of care.
- Discharge medication and discharge summaries.

This list is not exhaustive and it was recognised within the forum that competitor participants were cautious of how much information they were prepared to exchange. However, all participants believed industry needed to work together on the future development of electronic decision support systems in Australia to ensure its viability and success.

Participants welcomed a national approach and believed it would be beneficial in delivering systems that reflected the Australian environment.

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## **Question 2**

How might you expect accreditation and the application of standards to affect the design and implementation of electronic decision support systems in Australia?

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Industry believed that in the application of standards and accreditation, the following issues would need to be considered:

- An organisation would need to accredit content information that would be uploaded into vendor products.
- An organisation would need to decide what clinical decisions needed to be supported.
- Any form of accreditation would need to be independent and transparent.
- The ability to localise systems would need to apply as many systems are adapted to the population and location in which they are utilised.
- If knowledgebases had standards there could be a reduction in interfacing, integration and mapping costs as well as the costs of implementation.
- In-house knowledge should be permissible.
- In considering who may facilitate this role, industry did not believe that any one body currently existed that could incorporate all of the requirements discussed at the forum. They did believe it was the role of government to coordinate a collaborative approach.

Industry participants were concerned about the costs of the initiative. This process would need to be funded and once in place would need to be sustained. Industry was not confident that the long term sustainability of this process or a national system would occur without clear policy direction.

## 5 ANALYSIS OF THE FINDINGS

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The previous sections provide the findings from the literature review and the outcomes of both the one-to-one consultation and the forums. These materials are now synthesised and brought together within key areas.

This section of the report examines the key issues impacting upon:

- Clinicians use of decision support information and take-up of electronic decision support systems (Section 5.2).
- The health information industry's ability to develop electronic decision support systems in a competitive marketplace (Section 5.3).
- Provides some options on how these issues may be addressed (Section 5.4).

### 5.1 Introduction

From the literature, it is apparent that electronic decision support developments internationally, as well as in Australia, are clearly different within the various craft groups. There has been significant progress with electronic decision support systems by general practice, and to a much lesser extent, evident progress made by the specialists within the hospital sector.

In the broader areas of community based health services, it is in the area of community pharmacies that we see the emergence of electronic decision support systems as part of the dispensing process of medications, to be enhanced shortly by the availability of the Better Medication Management System (BMMS). New systems in community health, such as the planned roll-out of Centre for Health Informatics and Multiprofessional Education (CHIME) in New South Wales, will have a strong clinical focus and clinical content and will include some components of electronic decision support systems, for example, risk assessment and bring forward and reminder mechanisms.

Nevertheless, the major issues facing clinicians in these different sectors are remarkably similar although the specialists are most likely to be disadvantaged by the lack of economies of scale because of the degree of specialisation that characterises their part of the medical profession.

Through the course of the interviews it became clear that the health information industry needs to be explored under a number of dimensions:

- The knowledge component – evaluation and production of clinical guidelines and product information in a variety of media such as paper, CDROM and web based formats.
- The rules component – translation of knowledge into active rules that are then used within the electronic decision support systems.
- The software component – this component applies the knowledge, rules if applicable, and the local data concerning the clinical encounter and presents the electronic decision support systems functionality on the clinician desktop.
- The education and training component – this component covers educational activity concerning knowledge and its use at the under-graduate level, post-graduate level, continuing education, out-reach and consumer education.

In addition to the industry components, one can identify further additional requirements to ensure the diversity of the industry, and its ability to operate effectively, including:

- The building blocks component – the standards including data definitions, identifiers, terminology, messaging, format, directories, classifications and code sets as well as security, privacy and capacity building.
- The quality and safety component – covering the policy framework for quality and safety, the processes of testing, monitoring, and if appropriate, accreditation.

## 5.2 Clinical use of decision support and take-up

The result of the Australian interviews and forums are examined in the light of the United Kingdom experience of implementing general practice electronic decision support systems, and the United States experience of implementing electronic decision support systems in the hospital setting.

### 5.2.1 Cause to use

#### United Kingdom general practitioner experience

The major factors associated with the use of electronic decision support systems identified in a survey of 428 general practice respondents in the United Kingdom regarding the use of PRODIGY are reported as:

- computer skill level
- specific skills in the use of PRODIGY

- motivational factors (including time to learn and use)
- the general practitioner's comfort with the triadic relationship (between the general practitioner, the patient and the computer)
- the nature of the diagnosis.

### United States hospital experience

We identified much less information regarding uptake and use of electronic decision support systems in the hospital sector. The literature has suggested that the barriers are:

- lack of funding
- limitations of the vendor marketplace and product suitability
- reliability and integrity of systems
- history of poor and limited implementations
- perceived lack of benefits
- comfort with the triadic relationship
- additional time requirements
- resistance to altering workflow
- costs
- need for caution and supervision of their practical use
- over reliance and de-skilling of the clinicians.

### Australian interviews and forums

Our findings through the consultations and forums are that the following issues are consistently important to clinicians in the decision to use an electronic decision support system:

#### Effort and process

The electronic decision support systems has to be able to be operated as part of the normal process of care with minimal impact on the relationship between the clinician, consumer and computer.

The process of using an electronic decision support system must save time at least, and preferably save money for its sustained use by general practitioners.

Clinicians expect a productivity improvement from using technology, and electronic decision support systems is no exception.

## **Better quality of care and safety**

Clinicians expect electronic decision support systems to support the provision of better quality care, although there is no current expectation of improved clinical outcomes. Adverse events will be avoided by the use of electronic decision support systems. Evidence presented at the November 2001 workshop indicated a number of areas where improved clinical effectiveness could be expected, eg preventative practices in vaccinations, breast screening and colorectal screening.

There is an expectation that improved preventative care by general practitioners through the use of electronic decision support systems, and a proactive use of the guidelines for prevention produced by the Royal Australian College of General Practitioners (RACGP), will significantly improve the health and well being of the community.

## **Confidence in the knowledge base**

Confidence in the underlying knowledge base is a critical aspect of the causation to use an electronic decision support system. Clinicians will not use a system they regarded as unduly directing them other than on the basis of independent peer reviewed research. They regard access to that research as a necessary feature of the electronic decision support system. They expect that the knowledge within electronic decision support systems must match that of the most trusted experts within each area of clinical practice.

## **Comfort with the system**

The views expressed through the forums were that:

- Clinicians should feel ownership of the electronic decision support system and this would occur through their involvement with the electronic decision support system development process.
- Electronic decision support systems should have the ability to tailor responses for a range of users – general practitioner, specialist, consultant, pharmacist, intern, nurse and allied health professional.
- Affability (comfort with the system) and ease of use.

## **Availability**

The availability of the electronic decision support system has to be at the point-of-care. Further, the electronic decision support system has to be portable, pocket sized and available during peer-to-peer discussion that often takes place at informal locations. For such systems to become commonplace, it is necessary for them to achieve the highest levels of reliability.



The capability to keep the electronic decision support system synchronised with other data sets and latest evidence with a minimum of effort is essential.

### **Continuing education**

The availability of information on forthcoming guidelines and new guidelines themselves are seen to be an important aspect of clinician's continuing education.

Clinicians are also seeking electronic decision support system functionality to support clinical audits and benchmarking in their endeavours to improve clinical outcomes. These facilities will enable clinicians to monitor their own performance against their peers and provide important feedback to them.

As an adjunct to electronic decision support systems there is an outreach continuing education program of the National Prescribing Service of 'academic detailing' in relation to therapeutic guidelines. This type of service is likely to be required for the broad scope of the electronic decision support system and represents an additional cause to use electronic decision support systems.

### **Summary**

The context of the method payment of clinicians in Australia is a key issue in the cause to use an electronic decision support system. Setting that aside, there are distinct similarities between the causational factors across the information we found in the literature and our findings through the interviews and forums.

## **5.2.2 Important features of an electronic decision support system**

In support of the cause to use findings the most important features of an electronic decision support system as determined through the forums are:

- The processing of orders using rules based on the guidelines produced by the learned bodies. The status of that knowledge and its date of issue are required at the point of ordering as well as its reconstruction when a decision is reviewed retrospectively.
- Access to and use of relevant clinical information on the patient derived from other systems as well as information directly entered as part of the electronic decision support system process.
- The production of alerts based on a range of factors including known allergies and consumer specific information and the knowledge rules associated with the conditions and proposed interventions, investigations and medications.
- The availability of the evidence behind the decision support rules.

- Prompts and reminders to enhance prevention, recall and reminder processes.
- Information searching of Cochrane and other references that may not be contained within the knowledgebase of the electronic decision support system.
- Diagnosis support at the relevant stage of the consultation.
- Access to clinical pathways associated with the presenting problem and diagnosis.
- The ability to measure actual practice against peer norms through indicators at a range of levels, eg for an individual clinician, for clinicians across a practice or clinicians across a division or specialty.
- The ability to conduct concurrent as well as retrospective clinical audits.

The Taskforce should consider these aspects of functionality, and if agreed, communicate them to the health information industry as the priority areas for knowledge and product development.

### 5.2.3 Quality and safety

The main quality and safety issues identified by the forums were:

- The nature of the task.
- Jurisdictional issues.
- Content.
- System and testing issues.

These are now discussed in light of our consultations.

#### Nature of the task

The number of vested interests and the involvement of many stakeholder groups add to the complexity of ensuring quality and safety. There are overlaps between stakeholder groups and over time many councils and committee have been created to develop partnerships between the interested parties. This fact implies an extensive communication plan to reach this community of interest.

There are conflicting priorities between the need for privacy versus the clinical need for the availability of all relevant information. The use of shared information is potentially a cause of concern for clinicians because there may be important information suppressed at the consumer's direction from the health record.

Increased levels of quality in the provision of healthcare will also require more funding. An issue is who pays for this quality? Consumers have a view that high quality healthcare is expected already but they perhaps do not understand the

current level and their share of the cost of care provision, even before electronic decision support systems are introduced more extensively.

## Jurisdictional

The nature of Australia's health system involves many jurisdictions and the relationship of the states and territories with the Federal Government continues to evolve. The particular issue of electronic decision support systems is at different stages of consideration by each of the jurisdictions.

## Content

Some of the content issues relating to quality and safety are:

- potential for the duplication of data in different applications on the clinician desktop
- evidence
- trials to test the rules
- peer reviewed information
- the significance of the advice being provided
- the date the evidence was made available
- the context in which the evidence was used, and the ability to recreate the evidence retrospectively
- the ability to use the latest available evidence and the frequency in which evidence is updated
- implications of ignoring electronic decision support alerts
- unique identification of the patient
- consistent terminology and code sets
- Australian relevance.

## Systems

All systems and processes have a degree of failure. The most likely areas of failure of electronic decision support systems are not yet well known. The impacts are unknown therefore it is difficult to develop appropriate risk management strategies. Clinicians are still to be convinced that the new process involving electronic decision support systems does not introduce new quality and safety issues.

A range of electronic decision support systems will exist and a process for national uniformity of acceptance and use is expected. There is a further requirement for the

authenticity of the information provider to be identified, either through password or digital signatures, so that the users of the information can assess the credibility of the information.

The interface between clinicians and the developers of systems is an area that must be considered in the development of electronic decision support systems. This is a key concern of participants.

There is a general feeling that Australia should try to build on the work of others rather than develop from the ground- up. There may be opportunities in certain areas for local innovation as part of the overall development of electronic decision support within Australia.

## Testing

There is a need for the testing of the content, internal processing and delivery of the content as well as the production processes of electronic decision support systems. Pathology is a good example of an area with long established practices in testing algorithms.

End to end testing and evaluation is required. Accreditation of systems is a process of determining that systems meet the set standards. The experience of the United Kingdom suggests the need to accredit electronic decision support systems.

### 5.2.4 Legal

The legal position on electronic decision support systems is as yet largely untested in Australia. The literature search cites an important General Practice Computing Group (GPCG) paper on this topic as it relates to Australia.

Additional issues that arose in the course of the consultation are:

- Concern that the liability legislation might be tightened so that the defence of acting in good faith is no longer recognised.
- The need for risk management. The College of Pathologists have lived with the legal issue for many years in the interpretation of laboratory results. They are advocates for risk management, quality assurance and accreditation as essential elements of the process.
- Legal liability of the employer in hospital settings and the need for training of the employees.
- Electronic decision support systems should help in the discussion of the options between the clinician and consumer and lead to an informed shared decision and risk sharing. The triadic relationship is a key element.

## 5.2.5 Knowledge process

The knowledge process was identified in the report of the electronic decision support governance workshop as the path from knowledge to desktop. It is important to recognise this as a process that needs to be coordinated in order to progress the use of an electronic decision support system because it is at the point of care that each of the diverse range of contributions must present as an integrated view for the clinician.

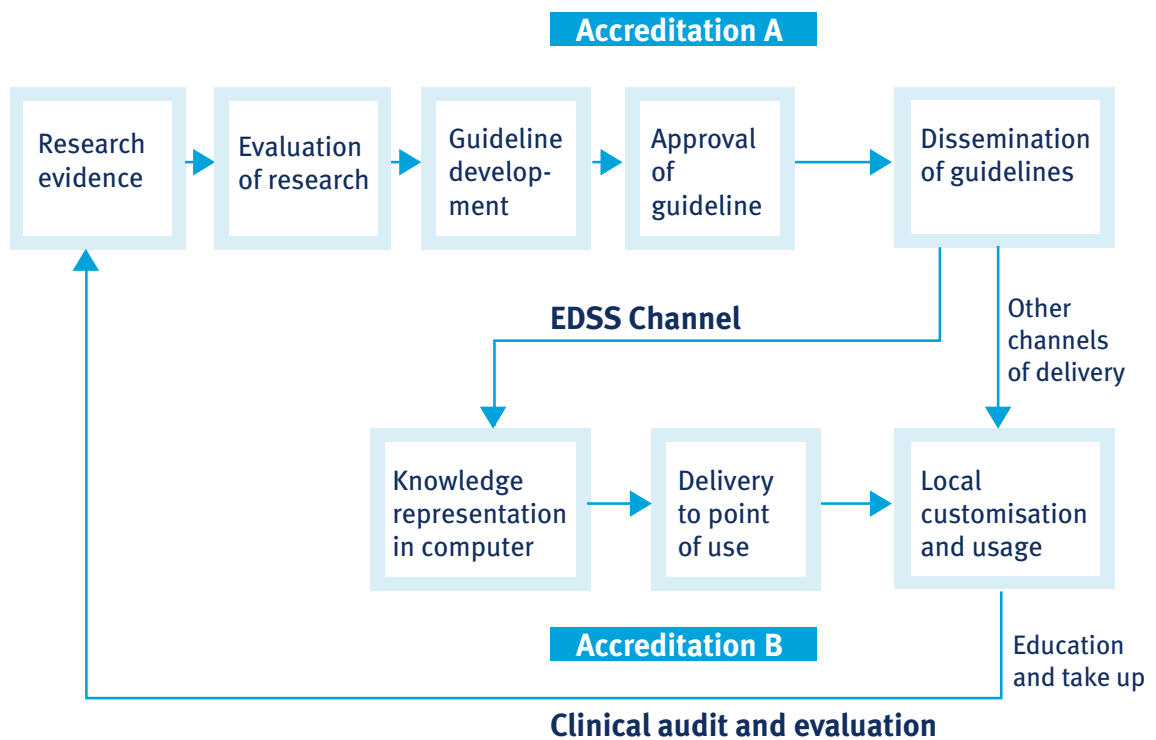
The nature of the process follows the various health information industry components we identified in the introduction. What differs under an electronic decision support system is that instead of each knowledge area having their own channels for their products, an electronic decision support system requires coordination of many elements such as terminology, format and structure in order to meet the delivery requirement through the electronic decision support system.

The elements of the process are:

- research
- evaluation
- guideline development
- approval through peer review
- dissemination (may be broader than just electronic decision support systems, that is through other channels)
- representation in computer form
- delivery to the clinical care setting
- clinician usage
- evaluation of efficacy (this loops back to the beginning of the process).

The process is shown in the following diagram.

**FIGURE 2 Clinical knowledge process**



Features of the process include:

- Several channels of delivery of knowledge to the point of use, one through the electronic decision support system and the others through channels such as printed materials or electronic reference sources.
- Two points of accreditation, one of the guidelines, the other of the translation of the guidelines into the electronic rules and their incorporation into the delivery software.
- Support to the local customisation of the electronic decision support system and its take-up.
- The feedback loop to inform the research process.

There are key areas of knowledge that if as a matter of priority were addressed consistently (in terms of format, terminology and index), would significantly improve their dissemination, representation in electronic form and delivery to the clinical care setting across the health sector, and accelerate the development of electronic decision support systems. These fundamental areas are:

- therapies
- pathology
- radiology
- immunology.

We discovered in the course of our work that there is a separate consultancy using Therapeutic Guidelines Ltd exploring this matter for the Royal College of Pathologists of Australasia.

## 5.2.6 Governance

### Governance in the United Kingdom

As one of the earliest adopters of Information Management and Technology (IM&T) and clinical decision support (for prescribing), the United Kingdom probably leads the field in primary care computing. Here the emphasis has been on accreditation, and more recently, the regulation of clinical content.

Accreditation of the proliferation of general practice systems in the early 1990's led to a dramatic reduction in the number of software vendors (itself an important issue in considering accreditation options for Australia). Accreditation was primarily concerned with functionality to support the previous Government's reforms (with the emphasis on supporting general practice fund-holding). All United Kingdom general practitioner systems were accredited in line with the Requirements for Accreditation and general practitioners were encouraged to purchase only accredited systems.

Requirements for Accreditation is still a requirement for general practitioner systems and is updated on a regular basis, in line with changing national information requirements. The emphasis of the Requirements for Accreditation is mainly administrative, with one exception – general practice systems must incorporate and use PRODIGY. PRODIGY offers clinical management advice following a diagnosis, including:

- prescribing and non-drug advice
- doctor/patient shared screens
- patient information leaflets
- advice on when to refer and when to investigate
- reference and learning materials available for use outside the consultation.

The management of PRODIGY now rests with the National Institute for Clinical Excellence (NICE). NICE's remit is to provide patients, health professionals and the public with authoritative, robust and reliable guidance on current “best practice”<sup>10</sup>, although its role is far wider than just the management of PRODIGY.

Clinical content for PRODIGY is provided by the Sowersby Institute of Health Informatics<sup>11</sup> under contract to NICE. Accreditation of clinical content involves

extensive clinical evaluation by recognised experts, and clinical content is updated regularly in line with changing best practice. A new Web-enabled consultation and validation process is being developed to speed up the process of validating new clinical material for inclusion within PRODIGY<sup>12</sup>.

### Governance in Australia

Clinicians believed that existing governance structures are operating in isolation and should be consolidated in a national approach to electronic decision support systems. They were not eager to see a new body created and when questioned on the role of the National Health and Medical Research Council, many were unclear as to how this would occur, citing the lack of breadth of the professional representation of this group as a concern.

Some clinicians suggested that a national entity with responsibility for electronic decision support may be one of the many existing government bodies that already perform a role in a governance process, however, it was also suggested that these bodies only perform part of what is required, or do not adequately represent the total breadth of the stakeholders of an electronic decision support system. In particular, the Nursing and Allied Health Professions are under represented at this level at a number of national forums.

The representative organisations believe that without significant funding being provided then a quality and safe environment for electronic decision support systems will not be feasible. This funding includes the resourcing of the vision of evidence based practice underpinning electronic decision support. Funding should also include incentives, where appropriate, to encourage the required changes.

There is a need for a consistent framework for e-health that includes the standards development required for the electronic decision support system. There is a need for authoritative national standards and mechanisms to include stakeholders including consumers and carers in the process of determining standards. There is a requirement to consider a process of accreditation against the standards and a process of review of compliance in Australia.

### 5.2.7 Standards

The responsibility for ensuring the coordination of the development of standards associated with the implementation of health information industry lies currently with the National Infostructure Unit in the Commonwealth Department of Health and Ageing. This activity is called the development of the building blocks and covers:



- standards for guidelines and handbooks, data definitions, messaging and communication, health record architecture, access control, security, coding and classification
- privacy
- security
- identifiers – consumer, service provider, facilities
- directories
- terminology (vocabulary)
- capacity building.

The progress on this activity is due to be evaluated over the next six months. However, it was not evident that many interviewees understood that this body is currently responsible, irrespective of the extent of progress made. A vehicle for the development of standards has been IT/14 and its sub-groups. A key issue is that there is no organisation that approves a standard. The standards are arrived at by consensus and are seen as goals for attainment.

It is only when an organisation requires that a standard be complied with in a product as a part of a contractual obligation does the standard form the requirement for compliance.

Implementation of the Health Level 7 (HL7) Standard in the Australian health environment is an example of this process. There is a desire for the use of a common messaging standard across Australia to facilitate many processes. The work of the IT/14 working groups has led to the development of the HL7 standard for Australia. Whilst a number of interviewees lacked confidence in the details of the IT/14 process, the process has been productive.

Thus the HL7 standard is the most probable candidate as the authoritative messaging standard. However, the current situation only requires all parties to voluntarily adhere to a standard. If the state/territory public health authorities choose to mandate this standard in their contracts then it would significantly influence the use of the standard in the many areas of the health messaging across the public sector. Even this level of specification is not as strong as a requirement that as a matter of regulation all messages in the health industry use HL7, for other than image transmissions.

## 5.3 Industry

Many of the issues faced by the clinicians are reflected in the responses by the software industry because the issues have a direct impact on both groups.

The following issues have been identified from the interview and forum process, along with suggestions as to how these issues may be addressed:

- level of investment
- government infrastructure
- standards
- partnership in innovation
- seamless electronic business processes
- sustainability of the knowledge component.

### 5.3.1 Level of investment

The implementation of a national approach to electronic decision support systems will produce a change in the culture in which clinicians work, and create a reliance on a new set of tools in the workplace. This is a real benefit but also creates an ongoing asset that needs to be managed in the same way any other assets, with an ongoing investment required to maintain the processes and the content of electronic decision support systems. Currently these are areas often neglected in the planning process of the states and territories and are frequently subject to funding cuts at times of budget review or when changes occur in government.

For a national approach to be successful and for the benefits to be realised, a change in the way information systems are funded needs to occur. There are several ways that this may be facilitated:

- The health software industry requires a boost in confidence that investment will not decrease under a future government. This is an ongoing issue that needs to be addressed given the extended length of time of the implementation process for most health information solutions.
- A long-term commitment by government to electronic decision support systems is required and could be facilitated by clear policy directions from the three major political parties.

### 5.3.2 Government infrastructure

An increase in the investment in the infrastructure within health facilities needs to occur to facilitate the requirements of clinicians and ensure quality and safety of electronic decision support systems. The current estimate of between 1 per cent and 3 per cent is far short of what is spent in other industries. Clear policy guidelines need to be formulated to ensure the long term efficacy of health systems in Australia.

Electronic decision support systems does not operate in isolation. In particular, in the acute setting, electronic decision support systems will inter-operate with a range of other systems, eg patient administration, emergency, pathology and radiology. All systems need to be considered as having an impact on the quality of the business process of using electronic decision support systems and must be considered in the long term view and planning process to ensure sustainability.

Infrastructure and telecommunications standards need to be clearly articulated and policy formulated to enable timely delivery of quality information at the point of care.

### 5.3.3 Standards

Standards are required in the areas of:

- guidelines and handbooks formats
- terminology
- data definitions
- messaging and communication
- health record architecture
- access control
- security, coding and classification.

National requirements for the following topics also have to be in place, and may require legislation at the Federal level:

- privacy
- security
- identifiers – consumer, service provider, facilities
- directories.

### 5.3.4 Partnership in innovation

The marketplace in Australia for electronic decision support is relatively small in comparison to the United Kingdom and the United States and this requires some reality thinking on the part of the consumer of health software. Two issues often emerge.

If Australia requires a system with applicability to an exclusively Australian market, then it faces costly ongoing maintenance costs, and the viability of such a product to an international software vendor is likely to be low. This is evidenced by the experiences of the States in the selection of locally developed software for their Patient Administration Systems (PAS).

If Australia utilises a system of international origin, it faces the cost of redeveloping the system to meet Australian requirements. Again the experience of converting PAS and international financial systems to meet the requirements of Goods and Services Tax (GST) are testaments to this fact.

The reality is that the market will contain products from both sources. Engaging the software industry early in the process and providing clear direction and requirements may result in savings in the future. This approach will also enable local software houses to have the information required for their own internal innovation and investment decisions.

### 5.3.5 Seamless electronic business process

Many of the benefits associated with the implementation of a national approach to electronic decision support systems require the system processes to be seamless. The reality is that within the continuum of care, there are many participants and many information systems, and a consistent approach is required in order to better realise the benefits of electronic decision support systems. This could be facilitated by:

- HL7 messaging standards to be uniformly adopted as mandatory requirements. This would ensure that over time, systems would be in a better position to share information and implementations would be simplified.
- Common approach to the implementation, testing and updating of systems within the healthcare industry via standards.
- Consideration of the workflow between processes and the interaction between systems at each point in the process.

### 5.3.6 Sustainability of the knowledge component

Many of the representative organisations involved in the knowledge component of the health information industry are dependent on their product revenue as a significant component of their funding. This funding enables them to remain largely independent of government funding. Thus any considerations concerning the use of their knowledge bases in the electronic decision support system must also consider the return on the licensing or other payment method for those materials.

For example, an earlier attempt to bring together the knowledge components of the various intellectual property holders within the area of therapies failed due to the inability of the stakeholders to agree a pricing framework, amongst other things.

## 5.4 Options for the issues raised

From the terms of reference of the Taskforce, the main issues for consideration are that of governance and accreditation. In this subsection, we examine two options for governance on a national scale.

The two governance options presented are:

- 1 The “marketplace model” with the emphasis being on the knowledgebase required for electronic decision support systems remaining in the hands of the traditional owners.
- 2 The “centralist model” utilising the existing structures to take ownership of the knowledge at a specified point in its development.

Both models have the objective of national coordination, however, the marketplace model relies heavily on market forces, whilst the centralist model is more closely aligned to the United Kingdom model of centralised accreditation and regulation.

### 5.4.1 Governance models

The role of governance in electronic decision support should be to provide leadership, vision, future direction and support for multiple stakeholders. Governance should also provide standards, a quality framework and validation for electronic decision support systems and its future development. Currently, it appears that no organisation exists with the required terms of reference for the governance and management of electronic decision support systems, although many people do not appreciate the full extent of the responsibilities of existing organisations and the related work that is already underway.

More detailed options for the governance of electronic decision support are explored for each of the two models identified.

### Centralist model

In the centralist model, knowledge that is to be distributed through the electronic decision support system becomes the property of the governing organisation that we have called the National Electronic Decision Support Systems Board (The Board).

In terms of the knowledge process, the Board:

- coordinates and funds the development of relevant standards for the electronic decision support system
- has responsibility for approving the standards
- establishes an accreditation process for the use of those standards that are required within Australia for the operation of an Australian electronic decision support systems
- controls and manages the representation of the knowledge in a suitable form for its inclusion in the electronic decision support system.

The Board would be required to work within defined policies in respect of issues of privacy and security as determined by government.

The Board would be directly funded by government. The sale of knowledge to the Board required for an electronic decision support system would be regulated and a separate organisation established for that purpose.

### The Board

The Board is responsible for the governance arrangements associated with the creation, management and dissemination of knowledge associated with and through the development and operation of an Australian electronic decision support system.

Professional organisations are included on the Board including the Nursing and Allied Health Professions. Consumer participation should also be sought.

The Board would recommend via the National Health Information Management Advisory Council (NHIMAC) to the Australian Health Ministers that the Federal Government solicit state commitment to the longevity of electronic decision support systems via the Australian Health Care Agreements. Federal Government and state/territory alignment of decisions with necessary legislative and financial support would be provided by both the Federal Government and the state/territory funded healthcare providers. This would ensure compliance with a national approach.

Under the Board, reference groups would be formed to cover representation and working parties including:

- industry participation
- clinical participation
- knowledge management/bases (guidelines)
- quality and safety.

These reference groups would be responsible for advising the Board on operational and policy directions.

### **Marketplace model**

In the marketplace model, knowledge remains the property of the creating organisation through to its use in the clinical care setting. A national auspicing organisation that we have called the National Electronic Decision Support Systems Council (the Council) is required.

In terms of the knowledge process, the Council:

- coordinates and funds the development of relevant standards for the electronic decision support system
- has responsibility for approving the standards
- establishes an accreditation process for the use of those standards that are required within Australia for the operation of an Australian electronic decision support system.

The Council would be required to work within defined policies in respect of issues of privacy and security as determined by the government.

The Council would be initially funded by government but over time the Council would be funded through a levy on the sale of knowledge as the market develops. The Council would not own or licence clinical knowledge required for the operation of an electronic decision support system.

### **The Council**

The Council is responsible for the governance arrangements associated with the coordination of knowledge associated with and through the development and operation of an Australian electronic decision support system.

Professional organisations are included on the Council including the Nursing and Allied Health Professions. Consumer participation should also be sought.

The Council would act as an independent not for profit organisation in a similar manner to the various representative organisations that already exist.

Under the Council, similar reference groups would be formed to cover representation and working parties.

### Reference group's role

Under either model, reference groups would be required. Four reference groups are suggested.

- **An Industry Reference group** would participate to ensure a currency of information on emerging technologies was available and current market drivers were considered in the decision making process. Industry could be involved in the partnering arrangement with pilot processes and trial of systems under the auspice of the national body to ensure probity was observed. The group would provide a vital link in the uptake of standards and accreditation compliance and implementability.

The engaging of industry in the early development process will return a reduction in implementation costs in the future. This is supported by the views of industry during the interviews that without a coordinated national direction, there was no rationale for industry to invest further in electronic decision support systems in Australia within the current levels of investment. A national direction would increase market confidence and would encourage resurgence in innovation.

A coordinated funding process on key areas raising the overall level of investment would enable real gains in the marketplace to be realised.

Industry should continue to be represented on the IT14 Standards Australia Group and the various sub-committees to ensure the consideration of their views.

- **Clinical Reference Group** participation would ensure involvement by the professions utilising electronic decision support systems and consider issues around the application of the systems in terms of timeliness, uptake, education and training and trialling new delivery methods of systems. The group would provide feedback on clinician priorities in using electronic decision support, including the clinical interface, the requirements of knowledgebases, medication information, the use of clinical pathways and protocols and point of care issues.
- **Knowledge Management Reference Group** would enable the assessment of knowledge to be considered for inclusion in an electronic decision support system, by considering the information's source, authenticity, accountability, and suitability for algorithmic format. They would work closely with the Industry Reference Group to ensure compliance with 'approved' knowledgebases.



- **Quality and Safety Reference Group** would make operational the policies of the national entity on minimum standards and accreditation, would facilitate the implementation and provide policy input concerning legislation. Standards ensuring accuracy and accountability for industry would be a key role of this reference group.

## 6 FORWARD PLAN

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The forward plan applies to either model of national governance of electronic decision support systems. We use the term *auspicing organisation* to represent the selected approach to governance.

We have only selected major elements in the proposed work plan for the next two years. Once the *auspicing organisation* is established one of its first duties will be to develop a more detailed work plan.

### 6.1 2 year plan

#### 6.1.1 Establish auspicing entity for electronic decision support (governance)

There have been considerable project resources allocated to the area of electronic decision support systems. A national entity under either model will enable the reduction of the fragmented approach that currently exists in the application of electronic decision support systems. The consolidation of effort will increase accessibility, scalability and integration with existing systems due to coordinated planning and common approaches. The reduction in duplication of effort will enable economies of scale to be realised over time.

There has been significant support for a national entity from clinicians, representative bodies and industry – each having unique requirements for electronic decision support, but realising that a coordinated approach is now long over due.

Many of those interviewed expressed concern over the creation of another committee. The role of the new entity may be incorporated in the work currently being undertaken through the Health Online committees; however, the breadth of the representation of interests in those committees would need to be closely examined. The risk resulting from under representation in a national approach, is the jeopardising of stakeholder ‘buy in’ and under realisation of the benefits. In particular, Nursing, Allied Health and Community Health need to be more widely consulted and their interests considered more fully in a national approach.

This national entity would be established to implement the forward plan including:

- initial implementation
- policy direction

- resourcing initiatives
- improved delivery of research evidence
- the improved quality and safety of decision support systems.

### 6.1.2 Review the progress of the development of the building blocks

The current responsibility for the development of standards for the electronic health industry lies with the National Infostructure Unit in the Commonwealth Department of Health and Ageing. The National Health Information Management Advisory Council (NHIMAC) needs to review the outcome of the proposed evaluation of the progress made to determine the future positioning of the responsibility.

### 6.1.3 Establishing minimum Australian standards

The development of standards should be undertaken by an independent organisation and for this purpose Standards Australia is one appropriate forum to engage in this work. Australian Standards are often referenced in Federal or State legislation, and then become mandatory. Currently approximately 2400 Australian<sup>34</sup> Standards are mandatory, however most are used voluntarily by organisations that value their expertise and common sense. The standards need to remain practical and not set impossible goals, be based on sound scientific and evidence-based experience, regularly revised, and keep pace with new technologies.

Standards Australia provides an existing structure to facilitate this process and would play a important role in setting minimum standards for electronic decision support systems.

The role of standards would not preclude the role of guidelines in the knowledge base process but recommend to industry and health units what is the recommended process and use of accredited content in electronic decision support systems. Guidelines would still require peer review from within the craft groups.

Minimum standards need to be established and could utilise the standards process through bodies such as Therapeutic Goods Administration, Standards Australia (IT14) and National Health and Medical Research Council.

The auspicing organisation would approve standards as a basis for the accreditation process.

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<sup>34</sup> Australian Standards, Guide to Developing Standards

### 6.1.4 Develop a process of accreditation

A key role of the auspicing organisation is the registration of accreditation organisations. The actual accreditation could be conducted by suitably qualified bodies in their field, ie the Australian Council of Health Care Standards that is already engaged to accredit healthcare facilities, could have a wider role in accrediting electronic decision support systems, using appropriately trained personnel. Likewise, Joint Accreditation System of Australia and New Zealand (JASANZ) (ISO9001) could engage with representative bodies and Quality Management Services (QMS) within the community sector. This would enable fast tracking the application of standards to electronic decision support systems and a later review could determine if the process needs be altered in any way.

The process of accreditation could also apply to the use of guidelines with software developers being encourage via the procurement process to only use guidelines that have been accredited by the national entity.

The construction of an accreditation program should be a priority for the national entity.

### 6.1.5 Engage the marketplace in planning and innovation

In recognition of the valuable role that software suppliers play in enabling government to conduct business online, there is a need to create a dialogue specifically to help software vendors do business with the national entity in electronic decision support systems. There are currently a number of government organisations engaging in this process and this could be further enhanced by providing policy and planning at a national level to support work in progress.

The Health Informatics Society of Australia via its annual health informatics conference<sup>35</sup> has such an arrangement with vendors and further exploration of this would be a task of the national entity seeking to capitalise on current work.

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<sup>35</sup> <http://www.hic.gov.au>

# Attachments

# ATTACHMENT A: ACRONYMS AND ABBREVIATIONS

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ACSQHC	Australian Council for Safety and Quality in Health Care
ACHS	Australian Council for Health Care Standards
AHMAC	Australian Health Ministers Advisory Council
AIIA	Australian Information Industry Association
BMMS	Better Medication Management System
EDSS	Electronic Decision Support System
EHR	Electronic Health Record
EPR	Electronic Patient Record
GPCG	General Practice Computing Group
GPIMIT	General Practice Information Management and Advisory Council
HIC	Health Insurance Commission
HIPPA	United States Health Insurance Portability and Accountability Act
HISA	Health Industry Software Association
ICD10 AM	International Classifications of Diseases Version 10, Australian Modifications
IT14	Standards Australia Health Informatics Committee
IM&T	Information Management and Technology
JCAHO	United States Joint Commission on Accreditation of Healthcare Organizations
KLAS	United States organisation that monitors and reports on software vendor performance
MBS	Medical Benefits Scheme
MIMS	Monthly Index Medical Specialties
MSIA	Medical Software Industry of Australia
NAPS	United Kingdom National Accreditation and Procurement Service
NHMRC	National Health and Medical Research Council
NHIMAC	National Health Information Management Advisory Council

NHSIA	United Kingdom NHS Information Authority
NICS	National Institute of Clinical Studies
NICE	United Kingdom Institute of Clinical Excellence
PAS	Patient Administration System
PMI	Patient Master Index
PBS	Pharmaceutical Benefits Program
PIPS	Practice Incentives Program
PRODIGY	Electronic decision support system used by United Kingdom General Practice systems
R&D	Research and Development
RFA	United Kingdom General Practice System Requirements For Accreditation
SCHIN	United Kingdom Sowerby Centre for Health Informatics Newcastle (providers of PRODIGY under contract to NICE)

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# ATTACHMENT C: INTERVIEW QUESTIONS

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## Clinician Questions for Interview Process

### Question category: Personal information and exposure to electronic decision support systems

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Number	Question
1	What type of clinician are you? eg General practitioner hospital specialist, emergency department doctor, clinical consultant, nurse, allied health, community nurse or pharmacist.
2	What is your clinical specialty?
3	What do you understand by the term clinical decision support?
4	What electronic decision support systems have you used previously or currently use? What were the two most valuable features? What two things would you like to change?

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### Question Category: Information needs

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Number	Question
5	What do you believe are the information problems currently experienced by clinicians?  Prompt Issues can be volume of information, acceptance, rate of change and permeation of new practice.
6	What electronic clinical information would be of use to you in a clinical consultation?  Prompt Questions of fact (what is the side effect of?), questions of medical opinion (how do you manage a patient with xxx). Can also be non medical needs, ie When is the next diabetic education service tomorrow?
7	Do you feel you can incorporate all the latest knowledge about a condition into your decisions when treating patients? How often would you like help in arriving at a decision? How often do you seek help?

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## Question Category: Quality and safety of electronic decision support systems

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Number	Question
--------	----------

- |    |   |
|----|---|
| 8  | What do you believe are the quality and safety issues surrounding the implementation and ongoing use of an electronic decision support system?              |
| 9  | Do you trust the alerts generated by your electronic decision support? Should electronic decision support be approved in some way before use by clinicians? |
| 10 | What would be the advantages and disadvantages of a National electronic decision support system?  |
- 

## Question Category: Governance of electronic decision support

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Number	Question
--------	----------

- |    |  |
|----|--|
| 11 | What do you believe is the role for Government in electronic decision support system development?  |
| 12 | What are your thoughts on the need for regulation, accreditation and standards in an electronic decision support system?<br>Prompt<br>Who should be responsible? Where might the National Health and Medical Research Council (NHMRC) fit? |
| 13 | Can you see any legal implication in the implementation an electronic decision support system?<br>Prompt<br>Privacy, currency of data, non use of system information.  |
- 

## Question Category: Take-up

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Number	Question
--------	----------

- |    |   |
|----|---|
| 14 | What factors might motivate you to use an electronic decision support system? |
|----|---|
- 

## Question Category: Resourcing

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Number	Question
--------	----------

- |    |   |
|----|---|
| 15 | What suggestions could you make for the resourcing required to develop, implement and support an electronic decision support system?  |
| 16 | Time is the premium for clinicians. The expectation is that an electronic decision support system will take more time even after familiarity.<br>What opportunities do you see to compensate for this increased time requirement? |
| 17 | What do you see as the training requirements clinicians may require to take up an electronic decision support system?   |
-

### Question Category: General comments

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Number	Question
--------	----------

- |    |                   |
|----|-------------------|
| 18 | Any other issues? |
|----|-------------------|
- 

## Representative body questions for interview process

### Question Category: Organisation information and exposure to electronic decision support systems

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Number	Question
--------	----------

- |   |  |
|---|--|
| 1 | What is the focus of your organisation?                                |
| 2 | Why is electronic decision support an important topic to your members? |
- 

### Question Category: Drivers for an electronic decision support system

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Number	Question
--------	----------

- |   |   |
|---|---|
| 5 | What would be the drivers for your members to use electronic decision support system? |
|---|---|
- 

### Question Category: Quality and safety of electronic decision support system

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Number	Question
--------	----------

- |   |   |
|---|---|
| 8 | How can the culture of clinical practice be changed to incorporate evidence based medicine with reduced errors?   |
| 9 | What concerns if any are there about quality and the ability to safely use an electronic decision support system? |
- 

### Question Category: National electronic decision support system

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Number	Question
--------	----------

- |    |  |
|----|--|
| 10 | What would be the advantages and disadvantages of a National electronic decision support system?                           |
| 11 | What is the role or the potential role of your organisation with respect to a national electronic decision support system? |
-



## Question Category: Governance of electronic decision support

---

Number	Question
--------	----------

- |    |   |
|----|---|
| 12 | What do you believe is the role for Government in electronic decision support system development ? (Governance, standards, regulation, credentialing accreditation)   |
| 13 | What are you thoughts on the need for regulation, accreditation and standards in an electronic decision support system?<br>Prompt<br>Who should be responsible? Where might the National Health and Medical Research Council (NHMRC) fit? |
| 13 | Can you see any legal implication in the implementation an electronic decision support system?<br>Prompt<br>Privacy, currency of data, non use of system information  |
- 

## Question Category: Resourcing

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Number	Question
--------	----------

- |    |  |
|----|--|
| 14 | What suggestions could you make for the resourcing required to develop, implement and support an electronic decision support system? |
| 15 | What do you see as the training requirements clinicians may require to take up an electronic decision support system?                |
- 

## Question Category: General comments

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Number	Question
--------	----------

- |    |                   |
|----|-------------------|
| 16 | Any other issues? |
|----|-------------------|
- 

## Industry questions for interview process

### Question Category: Personal information and exposure to electronic decision support systems

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Number	Question
--------	----------

- |   |  |
|---|--|
| 1 | What is the main focus of your industry?                                   |
| 2 | Are there areas of your industry relevant to electronic decision support ? |
-

### Question Category: Electronic decision support market capacity

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Number	Question
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- |   |  |
|---|--|
| 3 | How well do you believe industry is prepared to roll out electronic decision support, for both sales force and implementation capacity?  |
| 4 | Is there a need for the market to be stimulated and if so, by whom? And in what areas?<br>Prompt<br>Are there resourcing needs for start-up, research, piloting, partnerships? |
- 

### Question Category: Quality and safety of electronic decision support systems

---

Number	Question
--------	----------

- |   |   |
|---|---|
| 5 | What do you believe are the quality and safety issues surrounding the implementation and ongoing use of an electronic decision support system?                                |
| 6 | What are your thoughts on the independent evaluation, accreditation and application of standards of an electronic decision support system?<br>Who might facilitate this role? |
- 

### Question Category: Governance of electronic decision support

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Number	Question
--------	----------

- |    |   |
|----|---|
| 8  | What do you believe is the role for Government in electronic decision support system development?   |
| 9  | How might a National electronic decision support system be implemented or facilitated?  |
| 10 | Can you see any legal implication in the implementation of an electronic decision support system?<br>Prompt<br>Privacy, currency of data, non use of system information |
- 

### Question Category: Resourcing

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Number	Question
--------	----------

- |    |  |
|----|--|
| 11 | What suggestions could you make for the resourcing required to develop, implement and support an electronic decision support system? |
| 12 | What needs are there for ongoing support to the industry other than resourcing?  |
-

Question Category: Priorities and general comments

Number	Question
13	What are the priority areas of need for the industry to move forward?
14	Any other issues?

## ATTACHMENT D: FORUM PARTICIPATING ORGANISATIONS

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### Melbourne

Centre for Medical Informatics  
Royal Prince Alfred Hospital  
AMA  
AMA (VIC)  
Royal Melbourne Hospital  
MIHSR  
RPA/RACP  
Pen Computer Systems  
GPDV  
Peter MacCallum Institute/Monash University  
TG Limited/Latrobe University  
Pharmacy Guild

### Sydney

The Alliance, NSW Division of GP's  
NSW Health Department  
NSW Health Dept Office of the Chief Nursing Officer  
Trak Health  
NSW College of Nursing  
Royal Australian College of Physicians  
The Alliance of NSW Divisions  
Health Information Management Association  
I-MED Ltd  
Blackmores Ltd  
West Sydney Health Service  
West Sydney Health Service  
South Eastern Sydney Area Health Service  
IBA Health  
Pen Computer Systems  
Pharmacy Guild of Australia  
Pharmacy Consortium  
Dept Radiology, St George Hospital  
ED, Mt Druitt Hospital

## Brisbane

Brisbane Southside Central Division  
of GP's  
Queensland Health/Healthconnect  
Queensland Division of GP's  
Brisbane Division of GP's  
IWM Division of GP's  
Griffith University  
Queensland Health Info Strategy  
Queensland Health/Princess Alexandra  
Hospital  
Royal Brisbane Hospital  
Royal Brisbane Hospital  
Princess Alexandra  
Hospital/Queensland Health  
Queensland Division of GP's  
Royal College of Physicians

## Adelaide

SA Division of General Practice  
Royal Adelaide Hospital  
AMA  
University of SA Health Sciences  
WA Department of Health  
SA Division of General Practice  
Royal Adelaide Hospital  
Southern Division of General Practice  
HIMMA/DHS  
HIMMA/Repatriation General Hospital  
SA Division of GP's, AMA, RACGP  
RGH/Flinders Medical Centre  
AW Division of General Practice  
University of South Australia  
University of Adelaide

